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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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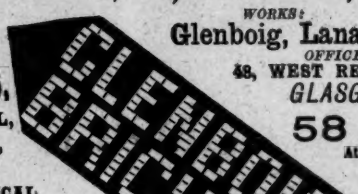

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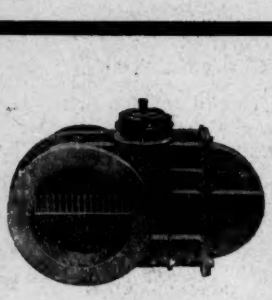
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EDITORIAL NOTES.

The Power Load—An Investigation Suggested.

It was a valuable paper which Sir Dugald Clerk, K.B.E., D.Sc., F.R.S., contributed at the annual meeting of the Institution of Gas Engineers, on the subject of "Town Gas for Motive Power." The communication, with the discussion, once again raises the question, "Is the gas industry doing all it might to preserve and extend its power load?" As to the importance of the load, there is no question. It is a five-and-a-half day per week one; its incidence is during daytime; and it continues throughout the year. The consumption per consumer is large through one service, meter, and account. Industry, trade, and employment are at low ebb now; and therefore the present is a very appropriate time—before there is a considerable revival, and industrialists begin to overhaul, replace, and extend their plants—to inquire whether the gas industry cannot separate this load from its ordinary supply, and give special facilities and terms in order to improve it. We have often felt, since electricity has been in the field, and has found it a good commercial proposition to supply energy at lower cost than for other less constant purposes, that the gas industry has lacked somewhat in enterprise in this respect, and has not attempted to do much, either defensively or offensively, in connection with this business. Another reason why there should not be procrastination in investigating this matter is the political influence that is being directed towards, and in favour of, electricity. The gas industry should not wait for the development of these things. While engaged in educating public opinion in respect of political errors in relation to electricity, it should at the same time be employing itself in the practical work of seeing what can be done to establish deeper, broader, and more firmly its own power foundations.

This, it appears to us, was one of the objects of Sir Dugald in complying with the request of the then President (Mr. J. Ferguson Bell) to contribute a paper at the meeting of the Institution. We know that the Derby Gas Company are giving particular attention to the power business. Many years' experience of gas-engine hire-purchase has led them to simple hire for gas-engines; and the manufacturers in the district have been greatly interested, and the Company are rightly becoming proud of what is being done. But it is not merely an isolated example of enterprise of this character that is wanted in this business to-day. A question of policy comes in which requires to be taken up by the industry from the general point of view—by, for instance, the National Gas Council appointing a strong and representative Committee to make a thorough investigation, aided by professional accountants, as suggested by Dr. E. W. Smith, and endorsed by Sir Dugald, to ascertain what is really the financial division between the power and the ordinary load. The matter is one which we have no doubt would find a willing supporter in the President of the National Gas Council (Mr. D. Milne Watson), who has recently been delving very much into the question of industrial power; and here there is a way of prosecuting the work in a companion avenue, and, likewise, to practical purpose. To an extent town gas is for power purposes handicapped by price just now, while before the war it was getting, or rather had got in many places, to figures that were easily competitive. Sir Dugald Clerk, however, sees no reason why the industry should not regard this as a special branch of their trading, and attempt to do more not only to keep the power already possessed, but to increase and even induce manufacturers (where the electric motor has not special advantages) to turn over to gas; and where electricity is used for both lighting and power, to persuade them to instal gas-driven generating plants, and obtain their energy at an average price below the average of the figures they are paying the town suppliers of electricity for lighting and power. The gas industry need not feel any compunction in doing this, any more than the electrical people have in attacking our cooking load. It is business; and we know which side in the competition has the greater fundamental advantages—if only they are grasped and developed.

Sir Dugald tells us that at present only about 10 p.ct. of the town gas manufactured and distributed in Great Britain and Ireland is used to produce motive power. Without looking into the matter, but taking a general survey of the distribution of the gas output between lighting, cooking, domestic heating, industrial heating, and power, we are not to-day altogether displeased to learn of that 10 p.ct.; but it only represents half of the stationary internal combustion engines at work in our factories. That 10 p.ct. must be progressively extended, though, at the rate at which the use of gas in other directions is being enlarged, it would be difficult to show as a percentage the rate at which special endeavours to augment the power load meet with success. The main feature in "special endeavours" is price, and that is what we want to get definite guidance upon—as to the consideration and factors to apply in determining the gas prices that can be offered to power users to retain and obtain new business. Compared with suction, pressure, or other producers, there are several advantages on the side of town gas; and manufacturers would rather have the constant quality and convenience of town gas than saddle themselves with any type of producer. But there is a price beyond which they cannot go even for the superior town gas, and that price has also to be competitive with electrical energy, for those cases where the electric motor has not the right to preference for convenience. And it is not only the powers up to 100 B.H.P., but above for which the gas industry should seek to cater. In the paper there are data which will assist in forming judgment as to what is a competitive price; and they should be studied. Consideration of them leads Sir Dugald to advise that everything possible should be done to reduce the cost of town gas for power to 4d. per therm, and that what the electricity people are doing in pressing hard for extending their power load should be countered by equal pressure on the part of gas undertakings working in conjunction with the gas-engine manufacturers. Of course, we recognize that if a new policy be adopted in connection with the power business, so that it could be dealt with on a competitive basis with other power agents (we have not only electricity in mind), it would be necessary in some cases to determine by statutory means the old-fashioned discounts clause which appears in many Gas Acts.

A Clouded Coal Position.

It is impossible for large users of coal to look upon the present position in the coal industry without grave concern. The trouble is that there are no means of forming any reliable judgment as to the future; and therefore every individual who is dependent upon coal for industrial or trade purposes is in a dilemma as to what is best for him to do. Prudence dictates preparation for the worst; the cost of doing so—including storage, removal from store, and depreciation—offers resistance. In the predicament, the fact that the price of coal is at a level lower than for years is a consideration; but, on the other hand, even at that cost, coal business between this country and abroad shows no signs of improvement, which testifies that—whatever may happen here, whatever agreement is effected with or without a stoppage—if the present export trade is to be retained and improved, the price of coal cannot ascend while market conditions abroad continue as they are to-day. The coal industries overseas are looking after themselves—not our coal industry, upon which they only keep an eye, and thank Heaven that British miners are controlled by the inflexible laws of the leaders in the Miners' Federation. What they think of those leaders they do not say. We can guess, and have fair confidence that our guess is not far from the truth. However, as to what is best to be done, it is for every individual concerned to take his own course. Even his coal factors cannot tell him what will befall. But we see reports that coal merchants are quietly getting hold of more stock, and that industrial fuels are more active. These conditions are no doubt welcome to the coalowners, with foreign buyers showing no particular interest in the conditions here; and it is not likely our customers abroad will be greatly perturbed while they can meet their requirements from other sources.

It is almost useless talking about the proposals that are likely to be made by the Mining Association and the Miners' Federation. There are rumours of all kinds floating round. To-day all that can be said definitely is that the Mining Association have given notice to end the present wages agreement. The notice dates from yesterday. Therefore it will be the end of July before a rupture can occur, if unfortunately there is to be one; and there are those who say that it is unlikely for reasons which are not far to seek. It is said that the Mining Association suggested a reversion to an eight-hour day; but the Miners' Federation will not consider any upward change from the seven-hour shift. The change would necessitate legislation; and as the Government would not be disposed to consider legislation except by the joint application of those concerned in the present statutory mining day, it is not likely that the Mining Association will push this important factor in coal costs. It is more likely they will concentrate on terms for the new wages agreement, with a view to improving the economic conditions of the industry. Both sides are agreed that a new wages agreement is necessary—the one from the point of view that the economic conditions of the industry must be improved, and the other from that of the men in the districts where poor output results in low pay. However, the owners cannot give what they have not got; the Miners' Federation cannot secure what is not there. They have got to make, however objectionable to them, their contribution to improve the conditions; and conditions will not measurably improve without a lower production cost per ton. The facts have to be faced. One thing the miners throughout the country should do is to take a greater interest in their own affairs, and throw overboard those extremists who have largely become masters of those affairs, and have assisted to bring about the present melancholy pass. All through the piece their policy has been present and extravagant advantage; the future had no concern for them. The one should not be considered without the other. The "future" of the seven-hour shift is here. What do the unemployed miners think of it? What do those on short time think of it? What do they all—employed and unemployed—think of the precarious position in which the industry stands? That position is to a serious extent due to the average cost of production per ton of coal.

Extension of the Coke Competition to July 31.

It has been represented to us that it would be a good thing to extend the period of the coke competition by a month. It is not our desire to do anything which would detract from what it is hoped will be the ultimate value of the competition to the gas industry—not only of this country, but of other countries. It has therefore been decided to extend the date for the final reception of papers to Friday, July 31; and no latitude will be allowed beyond that day. Several papers have already been received. The competitors whoever they are (and their names will not be known to the Adjudicating Committee until after the awards have been made in respect of the whole of the papers submitted) will in no wise suffer by the delay; inasmuch as the work of adjudication will take time. The members of the Committee will individually read all the papers before making their concerted awards. Not until after the whole of these have been made will the envelopes be opened which will reveal the names of the successful contributors. Through the individual reading by the three members of the Committee, the work will occupy more than the month of July—in fact, it is difficult at this stage to say precisely how many weeks will be required to perform the work faithfully and satisfactorily. But no time will be lost, within the limits of the ability of the Committee to carry out their voluntary and pleasing, though responsible, task.

Increased Sulphate Production—Vertical Retorts and Spent Liquor Effluents.

There are several matters of technical importance in the annual reports for 1924 of the Chief Inspectors under the Alkali, &c., Works Regulation Act—Dr. T. Lewis Bailey for England and Wales and Mr. J. W. Young for Scotland. Primarily, it is desired to direct attention to a matter which is of commercial importance, and which indicates the imperative necessity for maintaining the high state of efficiency to which the propaganda efforts of the Sulphate of Ammonia Federation have attained, as well as their organization for ascertaining movements in the fertilizer markets and requirements abroad. We know that behind the scenes there has been considerable activity to cultivate a demand commensurate with the increased production. But a word of warning is necessary. It is that the increased output should not in any way affect the endeavours of producers from coal carbonization to realize economy through the highest efficiency in the operation of their plants—to the extent that the higher efficiency will mean a reduced cost of production per ton.

In the first place, it will be noted that the number of sulphate of ammonia and gas liquor works registered remains practically stationary—564 sulphate works and 81 gas liquor works. Thus the considerable increase in the production of sulphate of ammonia that there has been the last two years is not due to any addition to the number of individual plants. In the increase that has taken place the contribution of gas-works, while good relatively to the experiences of previous years, is but a minor part of the whole. The aggregate of sulphate of ammonia produced in England and Wales last year was 362,180 tons, which is 34,184 tons more than in 1923, and no less than 86,879 tons above that of 1922. When one considers that last year, by producing 151,161 tons, gas-works showed an increase of 8181 tons over 1923 and only 6344 tons above the yield of 1922, a bulky increase has to be accounted for from other sources. As a matter of fact—still dealing only with England and Wales—coke-ovens, iron-works, producer gas plants, and synthetic ammonia contributed in the aggregate 211,019 tons, or 26,003 tons more than in 1923, and 80,535 tons more than in 1922. These are figures which require serious attention, because we know full well that coke-ovens and iron-works have not been operating to their full capacity; in fact, if it were possible to analyze the figures before us, we should not be surprised to learn that there was an actual decline from those sources. Therefore, the only conclusion is that the major part of the difference between the production of last year and 1922—86,879 tons, or 31·55 p.ct.—is due to the synthetic process. It has now come to a question of supply and demand; and it is upon the demand that there has to be concentration with a view to increasing it. It should be mentioned that

the tonnage figures given are ammonia products expressed as 25¾ p.ct. of ammonia, and that of the total of 362,180 tons, the equivalent of 31,878 tons was manufactured as concentrated ammoniacal liquor—the balance, 330,302 tons, consisting of other ammonia products—sulphate, chloride, nitrate, &c. The foregoing figures exclude the total for Scotland, amounting to 91,288 tons for 1924, which was a reduction on 1923 of 6306 tons. Of the 91,288 tons, 20,865 tons came from gas-works, 52,163 tons from shale works—the balance from iron-works, coke ovens, and producer gas plants.

In this report, Dr. Bailey only makes bare mention of the great development there has been in the output of synthetic ammonia and its products. It is, however, interesting to notice, in connection with bye-product recovery of ammonia, that the activities of the inspectors have resulted in improved conditions where these were required. It has been a strong point with the Chief Inspectors for some time past that, due to inefficiency of control, in not a few works there has been inefficiency of the process. This state of things is to be deplored; but it is a satisfaction to learn that nowadays the inspectors find that their past endeavours have been effectual. The information is also gratifying that complaints from outside regarding the working of plants have been very few indeed. But this does not apply to the effluents; for we see a statement in the report that there are, in different parts of the country, continued complaints as to their noxious character. In this relation, the inspectors have frequently made suggestions of methods of treatment whereby the oxygen-absorbing power of the effluents may be reduced; and it is now reported that an important advance has been made by the adoption at two works of the suggestion that the devil liquor should be evaporated. This can be done by spraying on to the bars of the producer fires or by other available means. Although the devil liquor may constitute only 10 to 15 p.ct., of the total effluent, it contains nearly half the total phenol; and therefore such a simple method of getting rid of this liquor has a considerable improving effect upon the works effluent. Further means by which there has been a reduction in the oxygen-absorbing character of the ammonia plant effluent have been by the introduction of air (where necessary) at a later stage in the operations of coal gas making, and also by the extraction of cyanogen. But, of course, the logical course to pursue, as mentioned by Dr. Bailey, would be to obviate the production of excessively noxious effluents rather than to obtain them, and have to treat them by reason of their noxious character.

The report also refers to the changes in the methods of carbonization through the introduction of vertical retorts, and to the fact that, in association with those changes, there has been comparatively little attention paid to the methods of removing tar and ammonia from the crude gas. Through the repeated agitation of tar with ammoniacal liquor much opportunity is given for the entry of soluble tar constituents into the liquor; and this Dr. Bailey points out is much more evidenced in the case of the vertical retort system than in that of the horizontal retort system. This explains the statement made in his speech at the Southern Association luncheon, as reported in the "JOURNAL" for April 1 (p. 37), and further referred to on p. 29 of the same issue. In his view, in the case of the new systems of carbonization, much could be learned from certain features of coke-oven practice—for instance, the early and more complete separation of tar by "shock" methods (the tar then being stored apart from the ammoniacal liquor), and more rapid cooling of the gas prior to scrubbing for ammonia. It is interesting to note that investigations are about to be made at two works on the effect of the separation of tar at the hot end of the system. Another suggestion is that it is by no means certain that with the newer methods of carbonization the best way of recovering the ammonia (at any rate, in large works) is that generally adopted. The question is asked: Is it not possible here also to borrow from coke-oven practice, and to reduce the amount of liquor produced, and incidentally the amount of effluent from the works? These are points well worthy the consideration of the gas industry, especially in these days of gas supply by calorific value instead of the old illuminating power standards. In another issue we shall be reproducing from the report interesting information arising from a further study of the treatment of effluent spent liquors from the distillation of ammoniacal liquor. This will be found to be a valuable contribution to the subject. In the past the attention of the gas engineer, it is pointed out, has been directed almost exclusively to the erection and working of the plant necessary for the due purification of crude coal gas. When horizontal systems were alone in use, this attitude of mind may have served well enough; but, with the advent of the vertical retort, conditions have changed, and effluent spent liquors from the ammonia still are now causing grave concern to sewage authorities. The report admits that there is just cause for this anxiety, owing to the liquors from vertical retort systems being heavily charged with the higher tar acids and other colour-producing bodies. Apart from this special source of contamination, to which ammoniacal liquors of a certain class are liable, it must be conceded that effluent spent liquors in general are of a highly polluting character; and therefore it is necessary to submit the conditions which control their genesis to the closest scrutiny for the purpose of determining whether or not it is possible to obtain a better product without undue cost or trouble. In this spirit the present research has been conducted. The results will be seen when we reproduce the section of the report in which this work is particularly dealt with.

Gas-Cooker Testing.

TIME was when it was very generally deplored that there was no recognized prescription for the testing of gas-cookers which could be regarded as reliable, and which could be universally applied. But that is not the case to-day. The matter was taken up and thoroughly explored by the Gas Investigation Committee, and to Mr. Arthur Forshaw, M.Sc., was entrusted the necessary research work; and in more capable hands it could not have been placed. A special report resulted, which included a specification for testing; and these evidenced the scrupulous care and the hard work that had been brought to bear upon the subject. Just as was the case at the time of original issue, so it is now very difficult, if not impossible, to find loopholes for any adverse criticism of the report and specification. There was submission of the documents at the meeting of the Institution of Gas Engineers last year; but beyond a brief explanation by Mr. Forshaw, there was no discussion upon them. On the occasion, interest seemed distant from the importance of the question. When we consider what a large element the consumption of gas for cooking is in the business of gas undertakings, and how persistently our electrical rivals are by one means or another endeavouring to get users of gas cookers to transfer their custom to electricity, the slighting reception of the report and valuable work was not what had been expected. As a matter of fact, we cannot help feeling that up to the present the report has been practically a wasted effort. However, we hope that before long there will be cause for changing this view. Anyway, a contribution to that end should be the paper which Mr. Forshaw read at the meeting of the Waverley Association last Friday, as reproduced in the "JOURNAL" to-day; for there is good reason shown in it, as well as in our business environment to-day, why manufacturers should only put on to the market gas cookers constructed to give a high efficiency, and why gas undertakings, by the application of the tests described, should see that their consumers obtain cookers which will, with the composition and calorific value of the local gas, and pressures at which it is delivered, afford them excellent results. Also when cookers come in for renovation, they should, if in suitable condition, be as far as possible remodelled with the same end in view. There are, of course, gas undertakings which vigorously put to test the gas-consuming apparatus and appliances which they purchase; but we are afraid these are the exception rather than the rule—particularly in respect of gas cookers. We hope that the days of neglect in this regard will soon pass.

What is worth doing at all in this way is worth doing well; and Mr. Forshaw's paper will be found a helpful guide. In it points of interest relating to the question of cooker construction and testing project from every paragraph; and we get in it an explicit understanding of the reason for every item in the cooker-testing specification. The paper may, in fact, be taken as a useful elucidating

supplement to the original report; and it will open the eyes of a good many as to how structural conditions in the oven and on the hotplate and the characterisitics and pressure of the gas have in combination their part in producing maximum efficiency, or, if not mutually helpful, of producing inefficiency. Also as to how, so as to allow a margin for fluctuations in the gas supply, compromises in structural features (which may slightly affect the maximum efficiency realizable under set conditions) have to be arranged—such as in connection with the flue outlet of the oven. Again, in connection with the hotplate, compromise has had to be effected between maximum efficiency and maximum convenience. The housewife does not, with the cheap B.Th.U. that gas places at her disposal, worry much about maximum efficiency (so long as the quarter's account is not seriously affected), but she does about maximum convenience. Thus it is that the grid tops which permit of flames and utensils having full direct contact without intercepting bars have had to give way to popular desire and a restoration of bars, but bars which are not guilty of abstraction and conduction of heat in the same measure as the old-style ones. However, that by the way. We are convinced that systematic testing by gas undertakings and patronage only of types which will show good efficiency under the conditions of the local gas supply, will gradually eliminate the production of cookers which do the industry no permanent good, and this will give still stronger foundation to the excellent section of the gas business which is provided by the cooker. We heartily commend a studied consideration of Mr. Forshaw's paper.

Electricity Supply by Gas Companies.

The second reading of the Statutory Gas Companies (Electricity Supply Powers) Bill has taken place in the House of Lords. There was opposition. Apparently oblivious of the fact that Special Orders have to be presented to Parliament for confirmation, and can then be subjected to opposition (if anyone so desires), some of the noble Lords seemed to be possessed of a desire to compel gas undertakings which wish to unite electricity powers to their present enterprise to take the course of applying to Parliament through a Bill. Some terrible things were predicted as to what might otherwise happen. For example, Lord Banbury remarked that the Electricity Commissioners would be able to grant concessions which had a pecuniary value, and that power might lead to corruption! That was not complimentary to the Commissioners. But the Government have no fear of anything untoward occurring; and they merely look upon the Bill as a useful part of the Parliamentary machinery. The Ministry of Transport hold the same views. Thus it was that an amendment for the rejection of the Bill was negatived without a division; and the measure will now proceed happily on its course. During the discussion, it was stated by Lord Raglan that some twenty-four gas companies have promoted Bills for, and have been granted, the power to supply electricity; and several gas companies in rural areas are willing to supply electricity, but cannot afford to promote Bills for the necessary authority.

Subsidies for Industry.

Replying to a question in the House of Commons regarding the closing of coal mines, the Minister of Mines (Col. Lane-Fox) stated that the only way the Government could keep a pit open would be by a subsidy. "That was not a course the Government would be justified in asking the taxpayer to undertake." If there is any definite proposal to State-aid the electricity industry, reminder may be given to the Government of the reply of Col. Lane-Fox. Coal is of greater importance to the nation than electricity. At the same time, we agree with the Minister of Mines.

Priority for Applicants.

The canvassing for money for the idiotic undertakings that have birth at 43, Cannon Street, is getting really laughable. On a previous occasion, we gave information as to one of their extraordinary productions, entitled the Southern Counties Electric Light and Power Supply Company, Ltd. Now, in connection with this impertinent flotation, a "Special" application form, marked "Priority," for debentures and preference shares has been received—£15,000 of 7 p.ct. mortgage debentures, at 98 p.ct., and £20,000 8½ p.ct. participating preference shares of £1 each, at par. The "priority" is wasted upon us. Our "obedient servants" the Company tell the recipient in a covering letter that the Directors "will be pleased to consider" his or her application "for a limited amount of preference shares and debentures." We have no doubt they will be. Any person who is foolish enough to apply for these debentures or preference shares need have no hesitation in limiting himself as to the amount for which he will apply, because we know sufficient of the methods of these gentry to authorize confidence that they will be only too pleased to consider applications for any amount of the sums mentioned above.

An Electrical Contemporary Speaks.

We observe that the "Electrical Review" has an editorial on the subject of promotions such as the one referred to in the preceding paragraph. It has long been our opinion that the gas industry should do something to protect the public against such prospectuses, in view of the fact that these people utilize lists of gas share and stock holders for the purpose of soliciting money for their discreditable ventures. The matter, we know, is under the consideration of the National Gas Council; and we also hope that it is not escaping the attention of the Committee appointed by the Government to consider the amendment of the company laws. Our contemporary speaks of the responsibility that also rests upon the electrical industry to watch and confute those who would "unscrupulously exploit its great and growing prosperity, and so cause discredit upon its good name." The drift of our electrical contemporary's article is that it fears great harm will be done to electrical securities among the uninitiated public; and this would be a great pity, seeing that the electrical industry will be inviting the investing public to subscribe many millions of pounds of new capital for future development. It stresses the point that the financial soundness of the industry must be safeguarded, so that there may be an uninterrupted flow of investment as the outcome of well-grounded confidence in electrical development.

Coal Exports.

The Board of Trade have issued their returns of exports of coal for May, and for the five months of the year. During May, the total quantity exported was 4,652,464 tons. This figure compares with 5,479,875 tons for May, 1924, and 7,684,405 tons for the same month of 1923. The values for the three years were: 1925, £4,798,756; 1924, £6,678,328; 1923, £10,588,417. Of the totals mentioned, the quantity of gas coal shipped in May was 651,898 tons; in May, 1924, 769,291 tons; in May, 1923, 903,876 tons. The value of last month's gas coal exports was £619,091; and this represents an average value per ton of barely 19s. The value of the sales abroad in May, 1924, was £910,773, and for May, 1923, £1,168,485. In the five months of this year, 22,114,598 tons of coal of all sorts were exported, compared with 26,248,766 tons in the corresponding period of 1924, and 33,220,230 tons in that of 1923. In these totals, gas coal was represented as follows: 1925, 2,937,991 tons; 1924, 3,442,586 tons; 1923, 3,923,019 tons. The values of the gas coal for the respective five months were: 1925, £2,934,024; 1924, £4,150,469; 1923, £4,704,620.

Gas Coke Shipments.

The quantity of gas coke sold abroad in May amounted to 25,197 tons, compared with 38,616 tons in May, 1924, and 64,333 tons in the same month of 1923. The reported value of the quantity shipped in May was £32,950, which averages £1 6s. 1·8d. per ton. The value in May, 1924, was £69,203, and in May, 1923, £100,448. In the five months of this year, the total quantity of gas coke exported was 208,974 tons, which compares with 408,092 tons in the corresponding period of 1924, and 446,771 tons in that of 1923. The values for the five months were: 1925, £303,937; 1924, £715,073; 1923, £667,432. These figures show how seriously has been affected the demand for gas coke from abroad; and the same applies, but with still greater severity, to metallurgical coke.

Sulphate of Ammonia.

During May, 15,412 tons of sulphate of ammonia were exported, as against 18,119 tons in May, 1924. During the five months, 114,464 tons have been sent abroad, which is rather more than 3000 tons less than in the same period of last year. So far this year Spain and the Canaries have been our best customers. They have taken 50,106 tons of the total quantity exported—nearly double the amount for the same five months of 1924. Japan comes next with 17,582 tons; but this compares with 40,421 tons in the corresponding period of 1924. The Dutch East Indies have been customers during the five months to the extent of 15,334 tons, as against 14,978 tons in the same period of 1924.

Tar Products.

There has been a very heavy fall in the exports of benzole. In May the quantity sent abroad only amounted to 1859 gallons, which compares with 287,800 gallons in May, 1924. In the five months of the year, 136,968 gallons have been shipped, as against 551,094 gallons in the corresponding period of 1924. Of naphtha, in May, 6588 gallons were shipped, as compared with 38,312 gallons in May, 1924. In the five months, only 21,814 gallons have been sent abroad, which contrasts with 138,315 gallons in the corresponding period of 1924. Taking tar, oil, creosote, &c., together, it is seen that 4,217,855 gallons were exported in May, as compared with 5,163,983 gallons in May, 1924. In the five months, 16,161,867 gallons were sent overseas, as against 16,676,804 gallons in the same period of 1924.

Coal Carbonized and Coke Yield in 1924.

In the recently issued annual report of the Chief Inspector of Mines, details are given regarding the coal carbonized and the production of coke during 1924. In regard to gas coke and breeze, it is stated that the quantity sold in Great Britain in the year was 7,419,805 tons, as compared with 7,542,867 tons in 1923. Respectively the values at the works are returned as £10,854,517 and £9,978,935. The quantity of coal used in the manufacture of gas last year was 18,104,400 tons, as against 17,202,476 tons in the previous year. Regarding coke-ovens, a tabulated statement shows that the quantity of coal carbonized for the production of metallurgical coke was 18,862,492 tons, as compared with 19,813,365 tons in 1923. The metallurgical coke made in 1924 amounted to 12,753,358 tons, as compared with 13,418,314 tons. The number of ovens in use is returned as 12,081, as against 12,639 in 1923. Of these, in 1924, 9067 were bye-product ovens, as compared with 9070 in 1923. The beehive ovens in use numbered 2583, as compared with 2961 in 1923; while other types were represented by 431, as compared with 608 in 1923. From these figures it will be seen that the number of bye-product ovens at work was maintained, while that for the beehive and other kinds of oven suffered considerable diminution. For briquette making in Great Britain, 1,088,242 tons of coal were used in 1924; this quantity being divided between: England, 21,468 tons; Wales and Monmouthshire, 1,014,209 tons; Scotland, 52,565 tons. The total quantity of coal used for this purpose compares with 1,049,360 tons in 1923. The briquettes made in Great Britain last year amounted to 1,189,518 tons, as against 1,149,089 tons in 1923. The value of the briquettes is returned as £1,700,495, as compared with £1,790,632 in 1923.

Tar Distillation in 1924.

One of the interesting features of the report of the Chief Inspectors under the Alkali, &c., Works Regulation Act is the information given as to the quantity of tar distilled in gas, coke-oven, and other works in 1924, and the quantity of pitch produced. The figures show the imperative necessity of doing the utmost to maintain all outlets for the utilization of this commodity. When it is seen that at gas and coke-oven works no less than 1,582,784 tons of tar were distilled, and at other works 12,219 tons, and that the respective quantities of pitch produced were 541,546 tons and 5791 tons—this in England and Wales alone—it is an emphatic reminder (if one were needed) of the vast importance of this business. In Scotland, the total tar distilled last year was 218,725 tons, and the amount of pitch produced was 77,885 tons.

PERSONAL.

Among the names in the King's Birthday Honours list was that of Councillor W. J. MAIR, J.P., who received the O.B.E. (Civil Division). Councillor Mair, who is Chairman of the Luton Local Employment Committee, is on the works staff of the Davis Gas Stove Company, Ltd. He has been a member of the Luton Town Council for nearly six years, and has been a Borough Magistrate since 1918. During the war he served on the County Appeals Tribunal. At one period he was Treasurer of the Luton Divisional Labour Party; and he is a former Chairman of the Luton Trades Council.

Mr. R. J. MILBOURNE (I.P.M., Murdoch Lodge) was on Thursday last invested as the Grand Sword Bearer to the Provincial Grand Royal Arch Chapter of Shropshire.

To-morrow Mr. GEORGE P. MITCHELL, Engineer and Manager of the Blackburn Corporation Gas Department, has to undergo an operation. In consequence he will not be on duty for a few weeks.

"EVENING STAR" GOLFING SOCIETY.

The members of the "Evening Star" Golfing Society visited the Hadley Wood Golf Club on Wednesday, June 24, where they spent a very enjoyable day notwithstanding the climatic conditions, which were hardly those usually associated with Midsummer Day.

The morning medal round for the Davis Challenge Cup was won by Bro. Stephen Hay with the excellent score of 78 (92—14); W.Bro. H. W. Packham taking second place with 81 (92—11). It was suggested that the Scotch mist which fell during practically the whole of the morning assisted Bro. Hay very materially, the conditions then existing being almost identical with those generally experienced on his native heath! A bogey four-ball competition was played in the afternoon, Bros. Davison and Hay being the winners with a score of 3 up. At the later proceedings W.Bro. Cyril Davis, in his most happy vein, presented the prizes to the successful competitors. Bro. Fussell, in proposing thanks to the Chairman, expressed the pleasure it gave the members to welcome W.Bro. Cyril Davis among them again after his regretted absence from last year's meeting through illness, and to see him once more fully restored to health and vigour.

It is at present proposed to hold the next meeting of the Society at Moor Park early in October.

FORTHCOMING ENGAGEMENTS.

July 9.—COKE OVEN MANAGERS' ASSOCIATION (MIDLAND SECTION).—Visit to the works of Messrs. Stainby and Lyon, of Knottingley.

July 15.—INSTITUTION OF GAS ENGINEERS.—10.30, meeting of the Emergency Committee; 11.15, meeting of the Finance Committee; 11.45, Council meeting.

July 20-25.—ROYAL SANITARY INSTITUTE.—Congress at Edinburgh. H.R.H. the Duke of York has accepted the Hon. Presidentship of this Congress, at which Sir John Gilmour, Bart., Secretary for Scotland, will preside, and deliver the Inaugural Address. A health exhibition is to be held in connection with the Congress.

July 25.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit of members and their ladies to Lytham-St. Annes. During the morning the members will inspect the new gas-works at Eastham.

Activity of Iron Oxides as Purifying Material.

Technical Paper No. 332 of the United States Bureau of Mines deals with an investigation regarding the activity of iron oxides as purifying material. It has been found that each oxide has a best water content or range of water content, from the point of view of activity, and that the activity of dark red or black oxides is usually more sensitive to changes in water content than is that of the yellow or yellowish-brown oxides. The latter oxides are generally of lower specific gravity, and retain more moisture when apparently dry. The activity of oxides increases with rising temperature to about 120° Fahr. Most oxides that show high activity when fresh do not maintain this superiority when partly fouled; but in all tests of the activity of oxides the gas contained no air. Had it done so, those oxides that were initially more rapid might have revivified more quickly, and have maintained a higher average activity. So far as could be ascertained, the presence of acid or alkali in an oxide has little effect on the initial activity of the oxide in the absence of air, except as it affects the capacity of the oxide to retain moisture at any given temperature. Experiments with miniature purifiers, and tests during practical operation, seem to show that alkalinity is of definite advantage in improving activity, apparently because it promotes the formation of the more easily revivified sulphide of iron, Fe_2S_3.

ELECTRICITY SUPPLY MEMORANDA.

The Incorporated Municipal Electrical Association have been holding their thirtieth annual convention at Brighton; and the proceedings were altogether of an attractive character. The President was Mr. W. C. P. Tapper, the Borough Electrical Engineer of Stepney. In his address, he spoke of the progress that the electricity supply industry has made during the past thirty years. We congratulate the industry upon it, and this we can do wholeheartedly, because, although it is not to the liking of certain members of the electrical profession (if we are to take them seriously—such as "Meteor," who stupidly speaks of gas as being "moribund"), the same thirty years have seen the gas industry making more progress than it had ever done. Mr. Tapper states that in 1895-6 the number of units sold by the municipalities owning electricity concerns was in the neighbourhood of 30,000,000 kw.-h. The latest published figures give a total sale of 2,982,287,284 kw.-h. Reducing this to thermal value, we find it is equivalent to 101,994,225 therms. The Gas Light and Coke Company alone last year sold 167,686,298 therms! Assuming an average calorific value of 480 B.Th.U. per cubic foot, and excluding all non-statutory gas undertakings, the statutory concerns sold in 1923 1,159,807,694 therms. However, Mr. Tapper believes that the next thirty years will witness progress in the use of electricity out of all comparison greater than that of the last thirty years. The same belief as to gas exists in the gas industry. But for electricity, Mr. Tapper evidently includes railway electrification; for he says: "The development in the direction of railway electrification and the domestic demand will eclipse anything seen up to the present." Very properly he has great faith in the work of the Electrical Development Association; and in this connection he regards as a hopeful feature for the future the setting-up by the Electricity Commissioners of an Advisory Committee to report on measures to encourage domestic electrification, methods of charging, and legislative powers necessary thereto. As a member of the Committee, he can report that they are tackling the work in a very thorough manner. Regarding the operations of the Electricity Commissioners, the President spoke of the complexity and difficulty of their task, which prevent complaint being made of slow progress; but he hopes "that the foundations of future progress are being well and truly laid." The method of expression lacks perfect confidence. As to London, if the Commissioners' hopes are fulfilled, a Joint Electricity Authority will be in existence before the end of the present year; but Mr. Tapper sees little hope of a scheme of generation for London being in the hands of one central body, with distribution in the hands of the existing undertakings, before 1971.

Development and Problems.

New Legislation.

The electricity industry appears to be as much in the dark regarding the proposals of the Government respecting electricity development as are other people. The technical proposals to be incorporated in a Bill are at present under the consideration of the Cabinet; but nothing else is generally known. It is a question of "wait and see." But Mr. Tapper throws light upon some of the matters which the industry would like to have incorporated in a new Bill. The Council of the Association are using, and will continue to use, every opportunity to impress upon the Electricity Commissioners and the Government the urgent necessity of conferring full hire purchase, selling, and wiring powers upon all municipalities. A proportion of them have such authorization, obtained by Private or Local Acts of Parliament; and he points out that in most cases municipal gas undertakings have full selling powers. That is so; and probably Mr. Tapper knows that these powers are nowadays accompanied by a provision that the business shall be conducted on lines which will make revenue from it compensate for all associated outgoings. A matter with which we entirely agree with the President is that relief from profits for the rates should be absolutely prohibited, save in so far as "an undertaking may have made calls upon the rates, when those calls should be refunded with interest." We hazard the opinion that while most, if not all, the engineers at the meeting were of a like way of thinking, there were not a few municipal councillors present who take an opposite view from that of the President. Subject to repayment of any assistance received from the rates, the opinion of the President is that new legislation should provide that any surplus, after paying working expenses, capital charges, and the writing-out of capital account of dead assets, should be used in: (1) The provision of an adequate reserve fund; (2) reduction of charges to the consumers; (3) transfer to capital account, to avoid fresh borrowing to the extent of such transfer. We are not altogether with the President on the last-named point. It is good finance to provide for replacements out of revenue; but we do not believe in existing consumers being made to find new capital for the future. They do quite enough in meeting current capital charges, sinking fund, and replacements.

Those Incompetent Electrical Contractors.

The question of the differences between gas undertakings and electricity undertakings in regard to dealings in appliances was also raised in a paper by Mr. L. L. Robinson, of Hackney. This contribution was on "Installation Policy;" and someone has said that henceforth it will be regarded as a classic on the subject, but we would rather describe the paper as containing a large amount of sensible commonplace, with intermingled points with which all people will not perhaps concur. The author says his endeavour has been to show-up weak links in the electrical service industrial chain. Electrical contractors form apparently one of the weak links. They came into existence through the early neglect by electricity undertakings of the service-to-the-consumer end of the business; but it was not until things had become established on a certain basis, and when too late, that electricity undertakings woke up to their responsibility for service to the consumer. The position is no fault of the contractors; and it will be difficult to mould it into something that would better meet the notions of the electricity undertakings to-day. It was altogether different with gas undertakings. In their early days, they had to be largely self-reliant, and this continued until it became an established condition. No specialized installation contractors grew up around the gas undertakings. Plumbers took just what work they could get, and so did ironmongers. Some municipalities have all their gas installation work done through the local plumbers or gasfitters; but that is by no means general. However, Mr. Robinson is highly complimentary to gas undertakings. He says: "The progressive electrical undertakings now find themselves educationalist traders in fierce competition for public favour with the gas companies, who spare no pains to give their consumers as perfect a service as is possible with the commodity they have to sell, giving immediate attention to all complaints, immediate execution of any installation work, hire, hire purchase, and even free installations and service to classes whose goodwill is especially valuable—such as doctors, architects, and other valuable professional gentlemen—through their own departments." We should like Mr. Robinson to explain what he means by "as perfect a service as is possible," because it would be interesting to discuss the points of divergence in this respect between gas and electricity. He must see too that, if the gas industry can satisfy such professional men as doctors, architects, and others, there can be nothing much wrong with their service from the point of view of either efficiency or economy. We were only reading a statement from a doctor just before writing this note in which he said that he had used both electric and gas fires; and his experience—and that alone—had led him to adopt the latter exclusively. The writer was in a doctor's waiting-room during cold weather early this year. In the room was an electric "fire" which refused to act; and the doctor said "the beastly thing was frequently going wrong at inconvenient times." That was his method of apologizing for its shortcomings. This electric fire, we understand, has been a warning to numerous people. However, that by the way. What Mr. Robinson wants is that electricity undertakings generally should have full power given to them to compete on equal terms with the gas industry. It is clear that all the vaunted advantages of electricity, and all the disadvantages that exist in the imagination of electrical men as being inseparable from their competitor, do not, even in combination, operate in their favour as they wish. However, we are afraid that what the author said as to the good things that would happen to really efficient contractors if the electricity supply business could be developed by full trading liberty being conferred on electricity undertakings, will not appeal to men engaged in the contracting business, and who have been long considering what would occur to them if they gave up their birthright. He blames the inefficient contractors for being mainly responsible for the "terrible position" of the installation industry to-day. He says that very few suburban shops have any pretence of good lighting, or even attempt any economical use of electricity. We will not dispute the point; but, accepting its truth, the statement of Mr. Robinson implies a serious dearth of efficient electrical contractors. Reading on, we are deeply impressed by the wickedness of the contractors, who appear to do everything possible to kill their own business. There is appeal to every undertaking to do its best to protect the consumers, and there are some kind words as to the value (which is obvious) of good contractors; but even the business of these Mr. Robinson manifestly would like to see transferred to the supply undertakings. He wishes to see hire terms for electric cookers the universal vogue; he has a dig at the wiring rules of the Institution of Electrical Engineers; he naturally wants to cater for all classes; and cheaper wiring is a desideratum. It is Mr. Robinson's view, it seems, that the business side of the electricity industry, in present circumstances, is in a very unhealthy condition.

For Lighting, but not Heating.

Recently the Borough Council of Stepney instructed their Standing Committees to consider the practicability of substituting electricity for gas for lighting and heating purposes in the buildings under their control. The Works Committee report the substitution of elec-

tricity for gas for lighting three of their depôts, and that they are proceeding with the replacement of gas by electricity in the street lamps. The General Purposes, Staff and Education, and Public Health Committees do not consider that for heating the replacement of gas by electricity can be justified.

Large Catering Establishments in America.

A point is often made in this country of the marvellous progress that has been made in America with the adoption of electric cooking apparatus. But when we get to close grips with the matter, through intercourse with men from the States or published statistics, the confirmation is difficult to trace. On the other hand, we do see in the data which arrive as to gas progress, that developments in gas cooking and heating there are going along at an unprecedented rate. An article has just been read prepared from one in the "Electrical World" which deals with the larger uses of electricity for cooking in America; but it does not appear that the providers of meals on a considerable scale in the States are so convinced of the "advantages" of electric cooking that they have flocked from the more reliable systems to the new one. It is calculated that in the States there are about 190,000 restaurants, hotels, clubs, and bakeries; but only about 4 p.ct. of these use electricity for any part of their cooking. A conservative estimate of the electrification of these establishments, it is said, would call for equipment valued at $120,000,000, and create a load of 3,000,000 KW.H., although it has been found that most installations do not require additional service facilities—the existing cables and meters being quite suitable for the purpose. This does not suggest that individual needs would be great. It is noticed that in the article before us references to "advantages" are (as is usual in this country) confined to the oven, and that the other parts—the larger consumption absorbing parts—of the "cooking" are not considered. But the "advantages" are all of the old order which changeth not, and which are so well known here, having for decades been heralded from the housetops and all other available places, to the end that we have in this country 5½ million gas cookers and grillers connected up, and the number is increasing daily. What our large caterers think of electric cooking is shown by the fact that gas is the cooking agent at the British Empire Exhibition, where 30,000 up to a quarter of a million people may assemble in a day.

"Safety" Items.

Manufacturers who depend upon central station supply for power do not in consequence have a continuously happy time. Those who have their own gas-driven plants for generating energy fare much better. Last Thursday week there was a fire at the electricity station at Nottingham. The tramcars were completely stopped; and many large business establishments—among them Messrs. Player's tobacco works—had to suspend operations. Those large manufacturing establishments which do not rely upon the Corporation for their supply of power experienced no inconvenience; and they set a lesson to those who have put their faith in the city supply. This stoppage furnishes another argument to add to others against large concentrations of electricity generating plant for the supply of extensive territories. On the 12th ult., Corporation employees were engaged repairing damage to an electric cable box in Church Street, Preston, when an explosion took place in the roadway at the corner of North Road. There were two loud reports, and a couple of flagstones and a grating were blown into the air. No one was injured, although a boy was flung to the ground. An unlucky stroke was made by a workman with a pick last Friday week in Union Street, Blackfriars Road. The pick touched an electric cable, which remonstrated in a surprising manner. There was a loud explosion followed by much flame and smoke. The cable continued to burn for about half-an-hour. The current was disconnected; and the fire was allowed to burn itself out. The incident caused a good deal of commotion in the neighbourhood.

THE ELECTRICAL UNIT AND THE BRITISH THERMAL UNIT.

What is Their Exact Relationship?

By H. J. HAILSTONE (Rochdale).

In a recent issue of a small provincial newspaper, a correspondent announced that "One Board of Trade electrical unit contains 3440 British thermal units," and in doing so he has been responsible for the writer of the present article spending a few interesting hours looking-up records. This experience will doubtless have fallen to many in the gas industry; and in order to obviate further loss of time, and in the interests of scientific accuracy, I think it may be well worth while describing the success (?) which attended my efforts.

The newspaper correspondent above referred to gives	3440
H. Davis, in a paper "Gas *v.* Electricity" before the Manchester and District Salesmen's Circle (for the report see the "GAS SALESMAN" for April), gives	3414
J. D. Troup, M.I.Mech.E., in an article on "Heating by Electricity" in the "Manchester Guardian," gives "1 KW.-hour is only equivalent to	3420 "
Dr. Margaret Fishenden, in "Problems of Heating" in the "Manchester Guardian" Gas Number, gives	3410
Mr. L. H. Thomas, in his presidential address before the Midland Juniors, in 1923, gives	3410
Mr. R. J. Rogers, at another meeting of the same Association, in 1920, gives	3420
J. W. Meares, in his book "Electrical Engineering Practice" (Spon), gives	3440
Kempe's "Engineer's Year Book," in Section XXX., revised by A. H. Allen, M.I.E.E., gives	3440
Whittaker's "Electrical Engineer's Pocket Book," and most of the popular year books, give	3440

It is rather astonishing that so much variation appears in statements defining the heat equivalent of an electrical unit; and though the above examples have been taken at random from the writer's bookshelves and cuttings files, it is likely that further search would result in the same degree of diversity or possibly "make confusion worse confounded."

It is perhaps natural for most electrical books to quote the higher figure; and in view of the existing keen competition from our electrical colleagues, it is desirable for us to use a correct figure in all statements. Discrepancies have probably arisen from the use of approximate values in making the calculations. Thus, in using the following generally accepted figures, the method of calculation may be given as:

1 KW.-hour, or Board of Trade unit = 1000 watt-hours = 1·34 H.P.-hours = 1·34 × 33,000 × 60 ft.-lbs.-hours = 2,653,200 ft.-lbs.-hours, or 2,653,200 ÷ 778 B.Th.U. = 3410 B.Th.U.

When, however, data in the C.G.S. system are taken, the corresponding calculation gives the figure 3414. Thus,

$$\frac{\text{1000 watt-hours}}{\text{Joules equiv.}} = \frac{1000 \times 10^7 \times 3600}{4{\cdot}184 \times 10^7} \text{ calories}$$

$$= \text{do. do.} \div \left(453{\cdot}6 \times \frac{5}{9}\right) \text{B.Th.U.}$$

$$= 3414 \text{ B.Th.U.}$$

It is suggested that this latter figure is the more correct.

WOODALL-DUCKHAM CONTINUOUS VERTICAL RETORT PLANTS.

The Gas Department of the Corporation of Dunfermline, on the recommendation of their Engineer and Manager (Mr. James Campbell), have placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for a further installation of continuous working vertical retorts. The plant will be in two settings of four retorts, and the order includes a complete coal and coke handling plant. The undertaking already has twenty 5-ton retorts.

The smallest continuous working vertical retort plant in Great Britain is to be extended. An order has been placed with the Woodall-Duckham Company by the Innerleithen Gas Light Company for the installation of one retort, having a nominal carbonizing capacity of 3½ tons a day. The present plant consists of two retorts of similar size, and has been working just over twelve months; the Engineer (Mr. James Shiell) being entirely satisfied with it.

The Isle of Thanet Gas Company, on the recommendation of their Engineer and Manager (Mr. J. M. Campbell), have placed an order with the Woodall-Duckham Company for an installation of the latest type of continuous working vertical retorts. This order is for eight nominal 10-ton retorts, complete with waste-heat boiler, gravity bucket elevator, tipping tray conveyor, and coal breaker. These retorts will be the largest continuous working vertical retorts in operation in this country There have been in operation on the same works for the last ten years twenty 5-ton Woodall-Duckham retorts.

The Corporation of Wallasey, on the recommendation of their Engineer and Manager (Mr. J. H. Crowther), are installing a waste-heat boiler, to be attached to their settings of Woodall-Duckham vertical retorts. The boiler will raise 5000 lbs. of steam per hour, at a pressure of 120 lbs.

THE CARPENTER CENTRIFUGE.

The Powell-Duffryn Steam Coal Company, Ltd., Bargoed, have placed an order with the Woodall-Duckham Company for a Carpenter centrifuge for coal drying. This plant will have a nominal capacity of 50 tons per hour, depending on the sizes of the coal to be dried. Guarantees have been given for drying flotation coal and washed duff. It will be remembered that a similar sized plant has been installed for the Nunnery Colliery Company. This has had some months' running, and is giving every satisfaction.

We have received from Mr. Arthur L. Griffith (the Secretary) a copy of the rules and list of members of the Society of British Gas Industries, together with the officers for 1925-26. Also a copy of the Society's half-yearly "Bulletin" containing the full account published in the "JOURNAL" of the proceedings at the annual general meeting and the speeches at the dinner on May 20.

SOCIÉTÉ TECHNIQUE de l'INDUSTRIE du GAZ EN FRANCE.

MEETING AT VICHY.

[FROM OUR SPECIAL CORRESPONDENT.]

THE Forty-Eighth Annual Congress of the Société Technique de l'Industrie du Gaz en France opened at Vichy, in perfect summer weather, on Monday morning, June 15; the President, M. L. ROLLAND d'ESTAPE in the chair. It was held in the Hall du Square de la Source de l'Hôpital, and there was a good attendance of members and visitors.

The first business was the election of new members and associates, thirty names being added to the register. Mr. Charles F. Botley, M.Inst.C.E., President of the Institution of Gas Engineers, and the respective Presidents of the American Gas Association, the Belgian Association of Gas Engineers, and the Swiss Association of Gas and Water Engineers were elected honorary members of the Société. The report of the Committee for the year 1924-25, and accounts for the year 1924 were then presented and adopted.

For service during the year 1925-26 it was declared that M. Rolland d'Estape had been elected President; MM. G. Vautier, O. Guillet, and Charles d'Aubenton, Vice-Presidents; MM. Baril and Chervet, Secretaries; M. R. Lesage, Treasurer; and MM. E. Chervet, L. Desanges, P. de Lachomette, H. Laedlein, P. Lebon, and R. Lesage, members of the Committee.

The meeting, which members only (not associates) were entitled to attend, then adjourned for luncheon.

In the afternoon there must have been between 300 and 400 present. The President opened the proceedings with a brief address of welcome. He thanked the Prefect of the Department of Allier, in which the town of Vichy ("la reine des villes-d'eaux") is situated, the Mayor of Vichy, and the various representatives from abroad, for the honour they had done the Société by their presence, and assured them of the warm appreciation which he and the members generally felt. The Prefect and the Mayor expressed cordially their acknowledgments.

Of foreign delegates there were present Mr. Walter T. Dunn, M.I.Mech.E. (Secretary of the Institution of Gas Engineers), representing Great Britain and Ireland; Baron E. Prisse (Past-President of the Belgian Association of Gas Engineers), M. de la Paulle (President), and M. Timmermans (Secretary), representing Belgium; M. Zollikofer (Secretary of the Swiss Association of Gas and Water Engineers) representing Switzerland; and a representative from Czecho-Slovakia, Dr. Tom Keclik.

The distribution of medals offered by the Government of France, and of the medals and certificates offered by the Société for faithful and long service in the employment of the gas undertakings followed on the introduction of M. Koechlin. These are awarded equally to workmen, staff, assistant engineers, and engineers. The term of service varied from 42 years 10 months (61 years of age) to 30 years 7 months (65 years of age). The Prefect handed the awards to the winners.

Next the report on the communications presented last year in Paris at the jubilee meeting of the Société was read by M. Chervet. Among those who were awarded medals for the best papers delivered was Mr. Thomas Goulden, M.Inst.C.E. (Past-President of the Institution of Gas Engineers), for his communication on the Gas Regulation Act.* A précis of each paper was given in the report; the most valuable points being indicated. Mr. Dunn accepted the medal on behalf of Mr. Goulden.

Then followed the reports of the Committees on: (1) Manufacture; (2) Distribution; (3) Applications. In the last-named, special attention was called to the fact that an office for dealing with technical matters in connection with heating by gas had been opened on Jan. 1, with M. L. Rolland d'Estape as its President. It is intended that this bureau shall form a liaison between the gas engineers, the manufacturers of gas apparatus, and those who instal the apparatus.

The meeting then adjourned, and in the evening the Société's official banquet took place at the Carlton Hotel, Vichy. The President was in the chair, and there were about 300 present. The banquet was served in the Grand Salon of the hotel—a beautifully decorated apartment, giving an exquisite setting to what is always regarded as the occasion of the week.

The first engagement of Tuesday morning was a visit to the gas and electricity works of the Compagnie du Bourbonnais, at Vichy-Cusset, a few miles from Vichy. Naturally the works are not large, but they provide an excellent example of a combined gas and electricity station, of which the Compagnie Bourbonnais possess ten, in various parts of France, Spain, and Algiers. They have a number of other works where gas only is manufactured. M. P. de Lachomette (President of the Company) received the visitors, and with the engineers showed them round. There are seven beds of nine inclined retorts, and four beds of seven in reserve. Coal is brought into the works by carts with horse haulage. Durham coal is used principally for the gas-works, and an inferior quality of coal for the boilers of the electric generating plant. An interesting feature was a small gasholder with columns of brickwork.

The business meeting was resumed by M. A. Nerrière's paper "Appareil de Sécurité pour Distillation en Dépression." M. Charles Delahaye then gave his paper "Description d'un Appareil simple permettant l'Evacuation Continue du Goudron des Barillets;" and M. L. Caussé followed with one on "Pistolet à Acide Carbonique Liquide pour le Soufflage des Canalisations de Petit Diamètre." The last paper of Tuesday morning was by M. Charles Deschamps on "Surveillance de la Fabrication par les Becs Témoins Comburimètres—Calorimètres."

After luncheon M. A. Nerrière read his paper on "Contrôle et Réglage Automatique du Tirage." He was followed by M. A. Grebel, whose subject was "Les Gazogènes Strache à Production Directe de Gas Mixte (Mélange de Gaz de Houille et de Gaz à l'Eau)." There was a very animated discussion on this paper; one of the speakers pointing out that the apparatus was not suitable for dealing with all kinds of coal. It may be remembered that its inventor, Dr. Strache, of Vienna, has devoted considerable attention to the subject, and is an accepted authority on it. M. P. Bachelay described "Le Tube 'Nedar' Défense Diélectrique des Canalisations Souterraines," an invention for the protection of telephone cables from the effects of electrolysis. The material of which the tube is composed appears to consist of compressed pitch. M. A. Guéret being absent, his "Note sur le Mélangeur 'Gévir' Injecteur-Diffiseur à Débits d'Air et de Gaz Réglables et ses Applications," was taken as read.

On Tuesday evening the Compagnie du Bourbonnais were the hosts at a banquet given in the Grand Salon of the newly-built Radio Hotel. M. de Lachomette was in the chair, and in an eloquent address of welcome alluded to the happy relations which had always existed between the municipal authorities and his Company.

On Wednesday morning, on the members being called to order, a paper entitled "Limites d'Inflammabilité—Dosage des Mélanges de Gaz Combustibles" was given in abstract by M. L. Caussé. M. G. Richard followed with one on "Méthode de Comparaison des Prix de Revient du Chauffage Central à l'Anthracite et au Gaz." An excellent contribution by M. J. Houel on "Tables pour le Calcul des Conduites de Gaz Comprimé" was ably abstracted by him. During the discussion, Mr. Dunn called attention to the paper on "Flow of Gas in Pipes," which had been read by Mr. Stephen Lacey before the Institution of Gas Engineers at Belfast, and had been awarded the gold medal. The last communication given, of the twelve prepared, was by M. A. Winkler, on "Le Chauffage au Poussier des Fours Ordinaires dans les Petites Usines à Gaz."

Votes of thanks were then passed to the Secretary (M. Mougin) for the excellent arrangements he had made for the meeting, and the admirable manner in which he had carried them through; and to all who had assisted in any way in securing so enjoyable and interesting a time for the members and their ladies during their sojourn at Vichy.

In the afternoon, on the invitation of the Compagnie Fermière de l'Etablissement Thermal de Vichy, there was a visit to the various features of interest in connection with the work of the Company. The visitors, as the guests of the Company, were entertained at afternoon tea at the Golf House, by courtesy of the Sports Club of Vichy, who had made honorary members of them all for the period of the meeting. On Wednesday evening the same Company offered a most enjoyable entertainment at the Theatre of the Grand Casino.

Thursday was devoted to an automobile excursion to the Monts de la Madeleine, with luncheon at the Hôtel du Grand Saint Louis, at Saint Alban. The scenery passed through was very fine, and the weather was all that could be desired. After luncheon all returned to Vichy, there to disperse to their homes, taking with them the pleasantest recollections of the Société's 1925 Congress.

* See "JOURNAL," Vol. 167, p. 327.

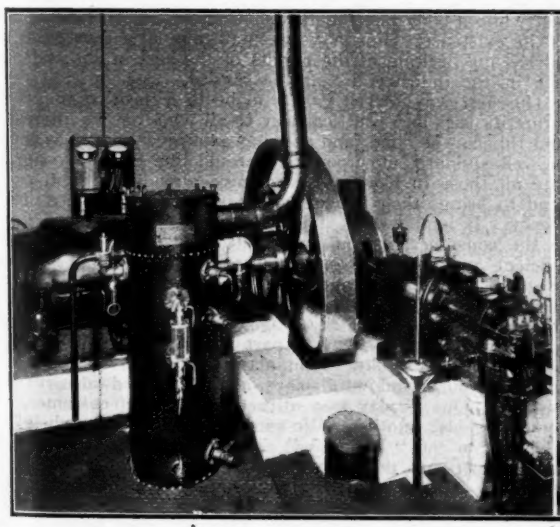
Books Received.—From Messrs. Ernest Benn, Ltd., No. 8, Bouverie Street, E.C. 4, we have received the following three books: "The Theory and Practice of Combustion," by J. E. Lister and C. Harman Harris; "Distillation in Practice," by C. Elliot; and "Autoclaves and High-Pressure Work," by Harold Goodwin. These volumes are published at 6s. (net) each.

BRITISH EMPIRE GAS EXHIBIT.

FURTHER VIEWS.

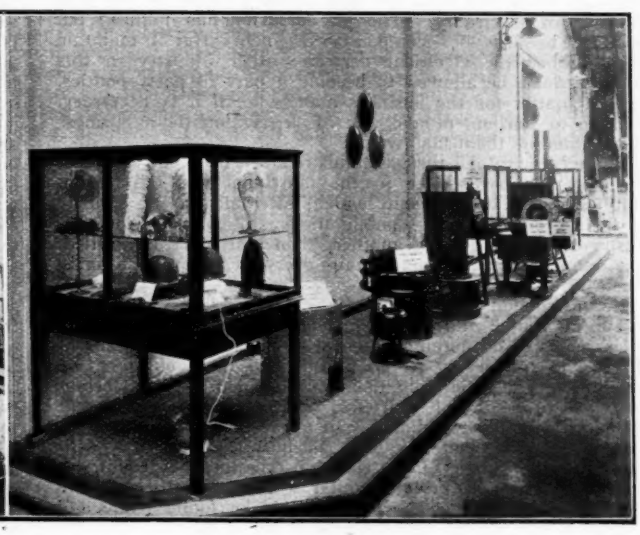
THE SMOKE ABATEMENT EXHIBIT.

Showing the comparison between the All-Gas House and the House with Coal Fires. The views from the windows show respectively the Sunny and Foggy Towns.



The Engine-Room.

Showing Spencer-Bonecourt Waste-Heat Boiler, Utilizing Exhaust Gases from the Engine.



Part of the Industrial Exhibit.

Showing Gas-Heated Furnaces; Sugar Boiler and Peanut Roaster; and Moulds for Hat Making.

GAS AT WEMBLEY.

It is impossible to wander for very long about the British Empire Exhibition—whichever direction one may take—without being struck by the remarkable character of the part which gas takes in it. The Gas Exhibit is doing its work as effectively as ever, and remains, both literally and figuratively speaking, one of the lightest and brightest spots in the whole Exhibition. From time to time one notices small additions, and touches here and there, which demonstrate that there is no falling-off in enthusiasm on the part of those responsible; and always, whether at the beginning or at the end of the day, the most perfect orderliness and spic-and-span appearance are to be found. With so large and varied an exhibit, and so much inducement for numbers of people to congregate and linger, this state of tidiness means much more than might on first thoughts be imagined. It is, indeed, evidence of an excellence of the organization and a thoroughness of the efforts of the staff which will be appreciated at its full value by those who are practically acquainted with exhibition work.

THE UP-COUNTRY STORE.

Reference has on more than one occasion been made in the "JOURNAL" to the Up-Country Store show in the Gas Exhibit. This well-equipped store—the special feature of which is that every single article in it is linked to the gas industry, either because it is a bye-product of gas manufacture or made from a bye-product, or because gas is habitually employed in one or more of the processes entailed in its manufacture—is proving of considerable interest to the public, as well as a valuable means of education in regard to the various uses of gas or its bye-products. An engaging little booklet entitled "On Imperial Service," which is now being distributed at the stand, affords valuable assistance in this educational work; for it contains an appendix which informs the reader in detail how gas serves the factories and workshops the products of which are on view. This list is a real "eye-opener" to members of the public who have not before thought very seriously of the matter. Another serviceable addition to the literature of the Exhibit is a chart indicating the variety and quantity of important and valuable bye-products recovered from the carbonization of 100 tons of coal at the gas-works.

"ON IMPERIAL SERVICE."

The booklet, well got up and illustrated, to which allusion has just been made, bears on the outside the words "On

Imperial Service;" and its subject is: "The Hearths and Homes of the Empire, and How they are Served by Gas—the 'Spirit of Coal.'" In addition to the useful information relating to goods displayed in the Up-Country Store, and the part which has been played in their production by gas or its bye-products, there are many interesting facts recorded with regard to gas supply in different parts of the Empire. For example, Montreal was the first city in Canada to use gas, as long ago as 1840; but within the following few years all the most important industrial centres realized the absolute necessity of following suit. Now the gas industry in Canada serves a population of over 2½ million persons, consuming at present 12,750 million c.ft. of gas annually. In Australia there are no less than 106 gas companies, producing about 18,000 million c.ft. in a year; while New Zealand possesses 51 gas companies, with an annual output of 4000 million c.ft. In all these, and in other, cases the industry is a rapidly growing one.

INDUSTRIAL APPLIANCES.

It will be remembered that last year the second hall housed a large number of industrial appliances. This year, however, beyond the two furnaces for enamelling jewellery and firing pottery, the whole of the industrial exhibits have been placed on the outside of the stand, where they now make an effective display of some of the ways in which gas can be applied to the various industries of the country. Near by are placed glass cases containing exhibits in the manufacture of which gas has played its part in one way or another. On either side of the main entrance industrial applications of gas are arousing much interest. On the one side there is the gas-heated wafer-baking oven, and on the other various appliances which enter into the manufacture of motor cars. Both these sections are illuminated by high-pressure lamps; while the industrial exhibits at the side of the stand are lighted by high-power low-pressure lamps. The different industrial exhibits have been labelled with cards explaining for what purposes the particular appliances are suitable; and these have proved most useful in attracting the attention of the public.

GAS IN CONNECTION WITH OTHER EXHIBITS.

In all there are some half-dozen Spencer-Bonecourt gas-fired boilers in operation in different parts of the Exhibition. A large and effective specimen is in connection with the extensive chocolate-making machinery of Messrs. Carsons, Ltd., the whole of which is run by one large Spencer-Bonecourt boiler. This supplies steam at 140 lbs., and consumes about 1000 c.ft. of gas an hour going at full pressure. Many other sweet manufacturing concerns are also using gas in substantial quantities. Last week, too, a new Leather Department was opened in the Palace of Industry by the Minister of Labour; and a gas supply has been introduced there for various processes.

Mac Fisheries are also using gas in quantities for fish frying; there being a good demand for such food at their open-air buffets. It is, we believe, quite a new departure for that firm. The consumption in the Exhibition as a whole is well maintained; the figure being about 450,000 c.ft. a day.

CORNISH ASSOCIATION OF GAS MANAGERS.

A Meeting of the Association was held at Truro on Wednesday, June 17, when Mr. F. R. G. GRANT, of St. Ives, delivered his

PRESIDENTIAL ADDRESS.

[Extracted.]

A subject which is uppermost in the minds of all those who are connected with the gas industry to-day is the subsidizing of electricity. The gas industry has nothing but goodwill towards her competitor as such. But I maintain that neither the electrical nor any other industry in this country must be allowed to become a part of party politics. It is a matter for the business man, who, if it is necessary, will go to Parliament and ask for legislation for a business proposition in the usual way.

The electricity and the gas industries are both out to render the best possible service to the individual and the nation. But when any Government, which, after all, has no security of tenure, decides to use public money to bolster-up one industry at the expense of another, then that other is entitled, nay, more, is in duty bound, to use every means in its power to frustrate such an unjust step.

Reconstruction and development, to my mind, mean building-up all round, and not tearing down. But to-day so much of it seems to do nothing but shatter the hopes and plans of those who are trying to go ahead with their business, by building-up and solidifying their various industries and bringing them to a state of high efficiency. If it is necessary that the electrical industry should leap ahead—and not mature by experience and steady growth, as has been the case with most of the largest industrial concerns in this country—then I believe that private capital would be forthcoming to carry it out, and that the public would be found ready and willing to pay for the benefits arising out of it.

No Government has the right, in any sense of the word, to make the public, and least of all those great public-service undertakings, both private and municipal, who have immense sums of public money at stake, to pay heavily to subsidize an industry with which they are in direct competition. It is not just, British, or good business.

I purposely am not giving you any figures to show just what the gas industry has at stake in the country, not only in money, but in men as well. These have been supplied to all of you, and very clearly, by the National Gas Council; and no doubt you have all read that convincing speech made by Mr. Milne Watson before the Society of British Gas Industries.

Let these two great industries do their own work in their own way, let the competition between them be fair and honourable, and free from the interference of outsiders, and let each admit freely the usefulness of the other, recognizing that both are necessary.

I want now to say a few words on education. I am sure we all regret that more cannot be done in our county to take up the Education Scheme of the Institution. Our works are small and scattered, and we have no large centres easily accessible. Up to the present little has been done, but most certainly not from lack of interest. We must keep this matter to the front at all times, and perhaps later on it may be found possible to formulate some practical scheme. We in Cornwall have reason to be justly proud. The Corbet-Woodall Scholarship at Leeds University has been awarded twice, and each time it has come to Cornwall. I mention this to give courage to any young men with ambition who are in the industry in this county, in any capacity. Let them feel assured that it is quite possible in the gas industry, which holds out such material possibility of advancement, to go ahead by means of hard work, and get, by steady climbing, to the top of the tree. They can always be certain that all the help which this Association can give them is theirs at all times.

No gas manager need be in doubt to-day as to what is best in the interest of his undertaking, his customer, and himself while a body like the British Commercial Gas Association is in existence. For a very small annual subscription the advice and backing of the results of the best brains and practice in the industry are at his service.

The best way to sell gas is to be in a position to demonstrate its uses in a practical way to all who may be interested; and this can be done, and is being extensively done, by means of well-equipped showrooms. I would like here to congratulate all those in Cornwall who have already brought, or intend to bring, their showrooms to an up-to-date state of efficiency. It is, however, fair neither to the undertaking nor to the consumer, if you show well regulated and thoroughly efficient appliances in your showrooms, but are not prepared to go to their houses and ensure for them the same efficient service there. This will probably mean a certain amount of free maintenance; but the wages paid for this work ought to be considered as much a part of your general service as are those of your stoker or mainlayer.

Make your window displays as varied and attractive as possible. One display may attract one class of customer, and something else another. We can get much practical help and advice from the "B.C.G.A." They know how to attract by advertising; and that knowledge is at the disposal of all.

Properly-trained gasfitters can do much for their employers. Their education is a very different thing now compared with what it was a few years ago. They are now being trained by the undertakings themselves, which makes them take more than an ordinary interest in their work. They are encouraged to take every opportunity which comes to them for increasing their knowledge; and in the larger towns these are very many. They realize that their position is one of responsibility and trust, and demands a high standard of service. Their work brings them constantly into touch with the consumers, and their advice is being regularly sought. We must see to it that they get every opportunity to make them competent to give that advice.

Do not let us class the man who owns a plumbing business as a rival. In reality we are his rivals; he was there first. Do not even class him as a competitor, but, rather, as a man working side by side with us. Make him feel that we are his friends, and that any knowledge which we have is always at his service. Invite him to visit your showrooms, and encourage him to deal with you for any goods he may require. Ask him to come to any demonstrations or lectures which you may give. It will tend towards gaining the confidence of the consumer, and will expel the old idea that he was being exploited. It will bring about a feeling of trust on both sides, and each will find out that there must be giving as well as getting.

On the proposition of Mr. HOARE (Falmouth), seconded by Mr. INGRAM (Truro), and supported by Mr. KINGWELL (Hon. Secretary) and other members, a vote of thanks was passed to Mr. Grant for his address.

GAS v. ELECTRICITY.

By "PLANET."

[This particularly frank article by a member of the Staff of an Electrical Undertaking is too good for disposal in any other way than presentation to our readers. They will be as interested in it as we have been.—Ed. "G.J."]

Judging from several articles in recent issues of the "JOURNAL," it would appear that many of your readers take "Meteor" of the "Electrical Times" very seriously—so seriously, indeed, that I am convinced that quite a number of them will lose their equilibrium in such a manner that they, on their part, will argue that, as far as energy for light, heat, power, and cooking is concerned, gas was, is, and ever shall be. Such a statement, of course, would be puerile—fit only to keep company with many of the filed outbursts of "Meteor" in the docket labelled "Tosh."

It is only natural that people should stoutly champion the cause to which they are attached; but if they boost their wares to such an extent that they succeed in extracting money from the public under false pretences, then they become guilty of sharp practice, and unfortunately there are such people in both the gas and electrical worlds. They appear to suffer from some form of hysteria in their mad fight to persuade the community that "ours is the best and cheapest." Why it should be, goodness only knows, as both industries are necessary, and able to make a comfortable living in complete harmony.

I often dream of the day when electricity will absolutely be the cheapest form of power for everything; but as I do not expect to live for a thousand years or more, I am afraid that my dream will not materialize. Periodically "Meteor" and his colleagues tell us of the imminent eclipse of gas; but they do not impart the information which will lead us to that end. Personally I am of the opinion that electricity supplied abundantly and cheaply will be the result of the efforts, not of a verbose journalist, but of a renowned scientist, who will not follow the spectre known as "One Hundred Per Cent. Load Factor," but who will revolutionize the means of production. However, I think we have yet to hail the birth of such a man. "Meteor" is very amusing when, as is known in the electrical world, he attempts to "swallow the gasometer;" but, generally speaking, he is not taken too seriously. He foretells the death of gas, but omits to name the weapon with which to slay the dragon, although the dragon has not done the world any harm at all. One might as well listen to the bleatings of our present-day politicians, who talk of turbines in coal pits, &c.

Electricity is undoubtedly a great power; but are we on the eve of an era when it will be patronized by the masses for every domestic use, for the simple reason that it is cheaper than gas? I think not. For lighting and power, electricity has made its presence felt in what were once the choice preserves of the gas industry; and even the gas people must confess that fair and open competition is good for the inhabitants of this world. But it is quite a different matter when we come to heating and cooking; and unless the "juice" can be sold at a flat rate of little more than a farthing per unit, I am afraid that gas will continue to be first favourite with the public. By "public," I mean the huge majority of people in Great Britain with incomes of less than £300 per annum.

The reduction in price of electricity to 1d. or 1¼d. per unit for domestic use has been cleverly boomed for the purpose of inducing the public to believe that it is cheap; but I am prepared to argue and prove that, at such a price, it is infinitely dearer than gas at 4s. 6d. per 1000 c.ft. It is nothing less than a damnable crime to tell the little man that he will save money by replacing his gas stove and heaters by electricity; and certain borough councillors should think very carefully before they get up in the council chamber and speak about "cheap and abundant electricity."

Because electricity for domestic use has been reduced from 3d. to 1d. per unit during the past four years, it does not necessarily mean that it is cheap. Figures can be made to prove anything, and statistics prepared by many electrical undertakings are not worth the paper they are written on. I know for an absolute fact that in certain towns where electric cookers are let out on hire the consumers are discreetly advised to retain their gas rings for boiling! Thus the electric stove is used for one or perhaps two "roasts" per week; and the various consumptions are taken to prepare the average which is broadcast to delude the public that electric cooking is much cheaper than gas!

For my own part, I ignore figures produced by both gas and electrical experts. Algebraic-looking data do not interest me at all. With my meagre salary and large family, money interests me, and labour-saving devices in my home are not to be countenanced. My wife has to "do her bit;" and had she insisted upon an all-gas or all-electric home, we should not have been married. Let me say, however, that I know plenty of people who possess all-gas or all-electric homes. Likewise they have a car, a maid, and a very useful bank balance. I possess none of these things, simply because my income is on the lean side. Consequently I want full value for my money; and because this is so, my lighting, heating, and cooking arrangements are as set-down herewith:

Lighting	electricity
Heating (main living-room with kitchener)	coal
Heating (sitting-room)	gas
Cooker	gas

Coal conservation should undoubtedly make us all think about the future of our country; but I am afraid that I am a selfish individual, and posterity must look after itself. Coal beats both gas and electricity in the home; and in the winter the coal fire keeps us warm, cooks our food, and boils our water, at a cost of something less than 4s. per week. This is something which gas or electricity cannot do. In the sitting-room (used occasionally) I have installed an up-to-date gas fire, because it is much cheaper than electricity at 1d. per unit; while my experience of electric cookers convinced me that they were much more expensive than gas stoves, and my gas accounts fully endorse my opinion. Not that electricity cannot cook food or boil water. It can do these things, and it does them very well; but the cost is frightful, as far as a man of moderate means is concerned.

I know what I am talking about when I say that many managers of electricity works are not going out of their way to instal electric cookers and heaters in the homes of "little people." These particular business men are keen on keeping their concerns financially sound! They made it their business to inquire into the status of many of their smaller customers who were nibbling at the "all-electric home" bogey; and the answers to their inquiries convinced them that small people could not, and ultimately would not, pay anything up to £10 per quarter for energy supplied and appliances hired. Naturally they do not refuse those good people who have more than their fair share of "filthy lucre;" but even so, they are not too anxious to overburden their distributing systems with heavily-loaded heating and cooking apparatus. Capital costs are a bit too warm at the moment; repairs are stupendous; while the improvement in the load factor, consequent upon the development of a domestic day load, is nothing to boast about. "Let there be light" is their motto—preferably at about 6d. per unit. Pioneer work respecting cheap units is left to certain of their colleagues, many of whom, after a fairly extensive run during which they have gained valuable first-hand knowledge, are hesitating, for many reasons, to launch out on a big scale in the direction of cooking and heating.

Let science show us how to produce cheap electricity, and fifty "B.C.G.A.'s" will not save the gas industry. Further, with cheap energy, the electrical industry would not require the services of the "E.D.A.," as a cheap article simply sells itself, and with no competition a Development Association would be a waste of money. At the present time, however, the "E.D.A." is necessary to "tell the tale;" but the going is rather hard at 1d. per unit.

At the moment, the price of electric light has to be kept in the region of 5½d. per unit in order to be able to sell cooking and heating units at 1d. There would be nothing to be said against this policy if 1d. per unit were cheap; but as it is dear at such a price, it simply means that the lighting consumers are being penalized for the benefit of a few people of liberal means who can afford the luxury of using electricity supplied to them at less than cost price. At the present time, to make the charge for lighting five-and-a-half times that for power is wrong. Paradoxical as it may seem, success would be achieved by the electrical people if they made the price of lighting twenty times that for power—*i.e.*, 5d. for light and ¼d. for power—but such a course, with present capital costs, would be suicidal, and the electricians know it. We are at the moment as far from cheap electricity as we are from the moon. "Meteor" says we are not; but did you ever hear of any commodity, dirt cheap, which required a State subsidy? Tell me, "Meteor"—I am listening very attentively. The fact that a subsidy is sought proves beyond all doubt that electrical people have been forced to eat their own words. In my opinion, we have as much chance of being supplied in the near future with cheap and abundant electricity as Balaam's ass had of winning the Derby!

I recently read of a Manager of a gas undertaking resigning his position because his Council insisted upon fitting-out a housing estate with all-electric homes. Not only should he not have resigned, but he should have supported the scheme "tooth and nail." The finest advertisement for a gas undertaking is the all-electric housing estate. The public hear nothing of the isolated cases of small people who have had a short but painful experience of running a home by electricity. Get 500 homes fitted-up with electric coppers, cookers, and heaters, and I will gamble that, upon the receipt of the first winter quarter's account, the particular company or municipal supply undertaking would be staggered by the vitriolic outburst of 500 deluded human beings. The "proof of the pudding is in the eating." One simply cannot get away from facts. Allow me to put down a few figures which will be helpful to the man in the street.

Carefully collected truthful data show that an electric cooker consumes 1½ units per person per day. Thus, if there are five in family, the consumption is 7½ units a day, or 675 units a quarter. An electric fire marked 2 KW. means that it takes

2 units per hour; and if care is taken to use it only five hours a day, the meter registers 10 units a day, or 900 units a quarter. An electric copper marked 4 KW. means that it takes 4 units per hour; and if used three hours only a week, it gives a quarterly consumption of 156 units—making a grand total for the quarter of 1831 units, which, at 1d. per unit, is £7 12s. 7d. for current alone. Meter rents, hire charges, and electricity for light will increase this to £10.

These figures are not exaggerated in any way whatever. I have assumed that the cooker is used in exactly the same way as one would employ a gas stove—*i.e.*, for baking, roasting, boiling, grilling, &c.; while I have taken the electric fire as being required on an average for five hours a day only, which is a very low estimate indeed. It is all very nice, very clean, and, omitting the boiling plates on the cooker, very efficient. But can you afford it? That's all. If you can, patronize electricity by all means.

Of course, I have seen other figures compiled (the vulgar say "wangled") showing the total cost to be about £4; but if careful inquiries were made, it would, I am sure, be found that the electric cooker had a valuable ally in the shape of a couple of gas rings. If, however, no gas or coal is being used at all, you may take it from me that an all-electric home for £4 per quarter means that the family generally sit on their hands to keep themselves warm, and that their staple food is bread and dripping! Electricity is not cheaper than gas; and I give this as the impartial opinion of a man who is not employed by a gas company, but who has spent rather a long lifetime in various capacities in the electric supply industry. Just at present I am connected with an electric installation man (a "curb-stoner"), and it has been my privilege on many occasions to listen to the candid confessions of many station engineers, who, proud of their profession, do not share the same sanguine views as "Meteor."

We are told that "all men are liars;" but there are a very large number of people engaged in the electrical industry who are not in the habit of telling lies. We in the trade are always yearning for cheap electricity—we dream about it. But it has not arrived yet; and for that reason we actually go out of our way to tell the truth to the simple public who have been led astray by the vapourings of a non-technical Press and those wonderful politicians who talk glibly of "cheap and abundant electricity" *via* super-stations, inter-linking, water power, sun rays, storm water, &c. It is all nonsense, and eventually will do us more harm than good.

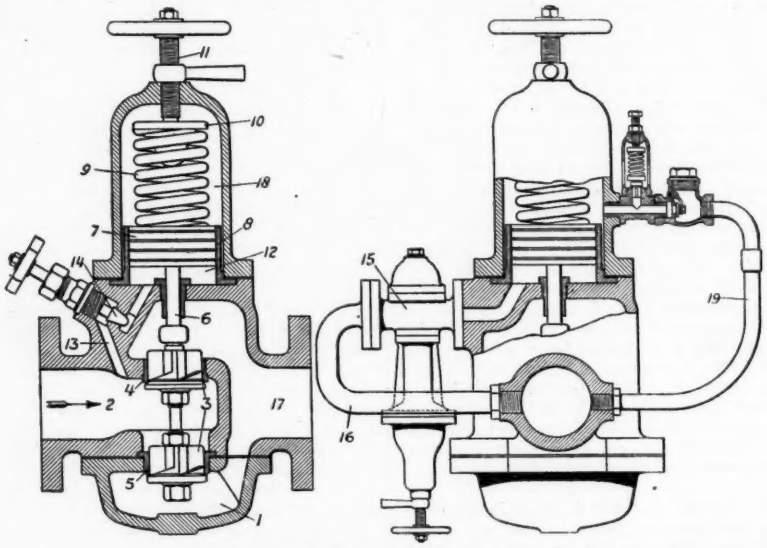
In conclusion, may I ask "Meteor" to tell the electrical people exactly "how to do it"? Anyone who wields a facile pen can say that "it will be," "it has got to be," "it must be," and "it shall be." In like fashion I have often promised myself a Rolls-Royce car; but I am still travelling by the "L.G.O." "Cut the cackle," "Meteor," and tell us precisely how we can sell at a farthing a unit, how we can get a load factor of 80 p.ct., and how we can keep our capital costs down. If you can do this, you will reach a pinnacle of electrical fame the like of which will make Lord Kelvin turn in his grave. If you cannot do these things, have a spark of pity for the people in the electrical trade, and cease talking like an idiot. You feed many of us right up to the back teeth.

THE "THERMODIN" REDUCING VALVE.

The "Thermodin" reducing valve recently introduced by Messrs. G. Dikkers & Co. (England), Ltd., of Effingham House, Arundel Street, Strand, London, W.C. 2, has been specially designed to overcome difficulties experienced in obtaining a steady flow of steam. Each "Thermodin" valve is independently constructed to meet the actual conditions under which it will be called upon to operate. One of the main features of the valve is that considerable variation in steam consumption has no influence on the reduced pressure.

The valves are made for three separate and entirely distinct purposes: (1) Reducing, (2) overflow, (3) overflow reducing.

Referring to the diagram, the general working of the valve is as follows: The high-pressure steam enters at 2. The entrance to the low-pressure piping 17 is regulated by the



double-beat valve 3, the position of which is determined by the piston 7, which is connected to the valve by the spindle 6, and is mounted so as to move in the cylinder 8. The position of the piston is determined by the tension of the spring 9 in connection with the pressure of the steam in the space 12 under piston 7, and the reduced steam pressure in the space above the piston, which is connected with the reduced side 17.

This steam pressure is conveyed from the high-pressure piping 2, through the passage 13 and a throttle valve 14, into the room 12, and is regulated by a small but very sensitive regulating valve 15 which discharges the steam to the low-pressure piping 17 by a tube 16. The steam that eventually might leak along the side of the piston will be let-off through the passage 19 towards the reduced side, so that there is no loss. A safety valve protects the space above the piston and the low-pressure piping from too high steam pressures. The passage 19 is equipped with a check valve opening in the direction of the low-pressure conduit, thus preventing irregularities when starting-up the apparatus.

Assuming that the pressure in the low-pressure piping is exactly equal to the reduced pressure for which the small regulating valve 15 has been adjusted, in that case the opening 15 is just closing. This will cause the pressure in the space 12 under the piston 7 to increase, so that spring 9 will be compressed and valve 3 lifted, leaving less passage-way for the steam. Consequently, at a constant consumption of reduced steam, the pressure there will fall a little, and the small regulating valve 15 will be opened again to a certain extent. Thus the pressure under the regulating piston will not increase any further—in other words, equilibrium has been re-established.

Should there be a sudden increase of steam consumption, so that the pressure in the low-pressure piping tends to fall under the adjusted reduced pressure, then the same occurrences take place in the opposite way. The small regulating valve 15 allows a little more passage, the pressure under the piston 7 diminishes, causing this piston and the valve to be moved in a downward direction, so that more steam at once will be admitted into the reduced side 17.

As already stated, the reduced pressure is equal to the pressure to which the small regulating valve 15 has been adjusted. From this it follows that the reduced pressure is determined exclusively by means of this small regulating valve. By adjusting the throttle valve 14 and the tension of the spring 9, even at the quickest variations in the steam consumption the apparatus will adjust itself immediately and without any oscillations.

It is thus clear that the pressure under the piston ranges from the high-pressure side to the low pressure; the pressure above the piston being equal to the reduced pressure. There is therefore always available the difference between these two pressures for controlling the double-beat valve, providing ample power to overcome both the piston and the frictional resistances. In the ordinary type of steam reducing valve this power is not available.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING IN EDINBURGH.

The Annual General Meeting of the Association was held last Friday, in the rooms of Messrs. Ferguson & Forrester, Ltd., No. 129, Princes Street, Edinburgh. Mr. ROBERT TAYLOR (Aberlady) occupied the chair.

The SECRETARY (Mr. R. J. Philp, of North Berwick) intimated apologies for absence from Messrs. J. W. M'Lusky (Glasgow), Campbell (Dunfermline), Bell (Dumbarton), Dickson (Dundee), Morrison (Glasgow), Hamilton (Glasgow), and George Clark (Chesterfield).

FINANCIAL STATEMENT.

The PRESIDENT said they would all be gratified to see that the Association was in a flourishing condition; there being a credit balance of £70 15s. 8d.

Mr. J. D. KEILLOR (Hawick) asked the Committee what they proposed to do with the surplus. The credit balance had been gradually mounting up; and it seemed to him that the Association did not require to have such a large surplus.

Mr. JOHN RICHMOND (Penicuik) thought the majority of the members would be pleased to know that the funds were so substantial. It denoted the healthy condition of the Association. The point raised by Mr. Keillor had, however, been discussed by the Committee; and there was a feeling that there might be a possibility of reducing the cost to members of either the luncheon or the pleasure excursion. Personally, he shared the opinion of the other members of the Committee that it was better to have a good sum of accumulated revenue.

The PRESIDENT said the Committee had recommended to the members that a donation of two guineas should be voted to the Scottish Salesmen's Circle. He would like to have the views of the meeting on this.

Mr. A. DOW (Galashiels) moved the adoption of the recommendation of the Committee. He considered that the donation was being given to a very worthy object.

The financial statement was unanimously adopted, as also was the recommendation of the Committee to vote a donation of two guineas to the Scottish Salesmen's Circle.

NEW MEMBERS.

The following were admitted to membership of the Association:

Ordinary.—Messrs. R. M. Simpson, Denny; James Robertson, Cardenden; A. M'Alpine, Pitlochry; H. F. Vernon, Stonehaven; B. Marshall, Kinghorn; and R. B. Waddell, Polmont.

Extraordinary.—Messrs. G. M. Hall, of Messrs. Thomas Glover & Co., Edinburgh; A. B. Brodby, London; and Arthur Forshaw, of Messrs. R. & A. Main, Ltd., Falkirk.

ELECTION OF PRESIDENT.

The PRESIDENT said that as his successor in office the Committee had pleasure in recommending Mr. Laurence Farquhar, of Peebles. He believed Mr. Farquhar would be acceptable to the members.

The nomination was unanimously agreed to.

Mr. FARQUHAR, in acknowledging the honour conferred upon him, said he could not at the present early stage state what form of entertainment the Town Council of Peebles would be prepared to give. He did know, however, that it was possible for the members to spend a pleasant day in Peebles, provided the weather was at all congenial.

OTHER APPOINTMENTS.

Messrs. J. D. Keillor (Hawick) and Thomas Black (Coldstream) were appointed to two vacancies on the Committee; while the election of Mr. R. J. Philp (Berwick-on-Tweed) as Secretary was unanimously agreed to.

A FORWARD STEP.

Mr. JOHN RICHMOND (Penicuik) moved, on behalf of the Committee, the following recommendation: "That ordinary members shall be managers of gas-works, and officially-appointed assistant managers of gas-works who make application for membership may be admitted." He explained that the alteration of this rule had been found necessary to meet some peculiar cases. For example, under the old rules the assistant gas manager in the City of Edinburgh could not become a member of the Waverley Association. It was an anomalous position altogether; and the Committee were unanimous in thinking that something on the lines of what was proposed ought to be done.

Mr. D. VASS (Perth), in seconding the motion, thought the Association were taking a forward step in opening up membership so as to include assistant managers.

There being no amendment, the resolution was unanimously agreed to.

Mr. R. TAYLOR then delivered the following

PRESIDENTIAL ADDRESS.

Gentlemen, I thank you for the honour which you did me in electing me president of the Waverley Association for this year—an honour which I appreciate very much.

I would like to relate to you my experience of supplying two villages by high-pressure gas direct through reducing governors into the low-pressure mains. When my Company took over the gas-works at Aberlady, in 1911, it was with the intention of giving a supply of gas to Gullane, a distance of 3½ miles from Aberlady, by erecting a new gas-works on a site midway between Gullane and Aberlady, and adjacent to the railway; but strong objections to this being raised by the residents throughout the district, this scheme had to be abandoned.

The next alternative was to give Gullane a supply from Aberlady, and it was decided to erect a new works adjoining Aberlady Station. The old Gas Company having recently relaid over a mile of 3-in. cast-iron main supplying a large consumer on the road to Gullane, it was decided to utilize this pipe and continue it with 3-in. steel, installing a high-pressure plant at the gas-works. It was their intention at first to erect a gas-holder in Gullane, and send the gas across at high pressure, and supply the village from the holder; but owing to the difficulty of getting a suitable site, and also owing to the objections of the residents in the district, they were compelled to abandon the idea, and supply direct through reducing governors into the low-pressure mains. I may say that, as we were dismantling the old works and erecting an entirely new works with a larger holder, we had a small holder to spare, which we kept for over three years while trying to obtain a site in the Gullane district. However, as it was deteriorating at the works, we were compelled to sell it.

We installed two James Milne rotary compressors, one with a capacity of 7500 c.ft. per hour, and one with a capacity of 4000 c.ft. per hour. These are direct coupled to "National" gas engines of 6½ and 4½ B.H.P. The outlet in the holder is 8 in. diameter with 4-in. branches for inlet and outlet of compressors, with an 8-in. by-pass valve in the centre, which is opened in the event of a breakdown, and also through the night when the engines are not running. The 8-in. main is continued down to the village of Aberlady, and a 3-in. branch taken off and then connected on to two 3-in. Bryan Donkin high-pressure reducing governors, and then into the low-pressure mains supplying Aberlady. The 8-in. high-pressure main is then reduced to 3 in. and continued on to Gullane, supplying a number of consumers on the way across.

Just before entering Gullane the 3-in. main was connected to two 3-in. high-pressure reducing governors, and then connected to the low-pressure mains.

In 1911, when the gas was turned on to Gullane, we were compressing the gas to a pressure varying from 20 in. to 40 in., according to the demand, and reducing at governors to 4 in. pressure. As the demand for gas increased, the pressure was gradually raised every year, until last year we were sending out at a pressure varying from 80 in. to 130 in.

As the demand for gas was steadily increasing every year, and this meant increasing the pressure considerably, we decided to lay a few lengths of 8-in. steel main, and to instal an 8-in. Bryan Donkin high-pressure reducing governor at Gullane, and gradually to taper into the 6-in. low-pressure main, keeping the 3-in. governors as a stand-by. Prior to our making the alterations the gas passed through the two 3-in. governors and two 3-in. square bends into a 3-in. tee-piece and taper piece into the 6-in. main; and whenever there was a large or sudden draw of gas we always had a drop in the pressure in the village. Since making the alterations we have had no trouble, and have been able to keep a steady 4-in. pressure. We have also been able to reduce the pressure at the compressors from 130 in. down to 60 in., which means a considerable saving in maintenance, gas, oil, wear and tear, &c., and also less pressure on the leather diaphragms of the governors.

One of the great disadvantages of high-pressure distribution is the liability of a breakdown at the compressors, causing a stoppage in the supply. I may say that we make a point of overhauling both compressors and engines every Saturday, and we thoroughly overhaul them every three months. Even with all the care and attention we give them it is impossible to prevent a breakdown occasionally.

As the compressor house is about 300 yards away from the retort house, we have a tell-tale in the retort house, which lets the stokers know whenever there is a drop in the pressure. Then they can usually get across and start-up the other compressor before the pressure falls too much on the Gullane district. A very common trouble causing breakdown is with the bunsen ignition tube of the engine bursting or the washers blowing out. About three years ago one of the blades of the compressor broke, and before the stoker got across to the compressor house and stopped the engine the whole of the inside of the compressor was smashed to atoms. As we keep a full set of spares ready fitted for both engines and compressors, we had the compressor ready for running again in about two hours.

Another trouble is bursting of the leather diaphragms of the governors, though this is a rare occurrence. We make a practice of cleaning and oiling all governors every three months, and we see that all vent pipes are clear. We also renew diaphragms every two years. One great advantage of high-pres-

sure gas is that it is perfectly dry, and we are never troubled with water in the mains or services. We have about twenty syphons on the pipeline, and we have found water only in the first two, which are close to the works.

In concluding, I would like to say that, in my opinion, it is not a paying proposition for a small works to supply high-pressure gas direct through reducing governors into the low-pressure mains. It would be an entirely different matter if we could run the compressor for a few hours each day, and fill a gasholder in the district, and supply from that holder. At present we are running the compressor eighteen hours per day, which means a yearly cost of about £250, which includes gas used for engines, oil, repairs, workmen's time, &c. Then there is always the possibility of a breakdown of any of the plant causing a stoppage in the supply.

Discussion.

Mr. H. H. GRACIE (Edinburgh) said he should like to congratulate the President on a very interesting and instructive paper. He was particularly interested in the undertaking Mr. Taylor had described, because about 20 or 25 years ago he (Mr. Gracie) had the privilege of reporting on the work. He did so on that occasion on behalf of one of the large consumers in the district. At that time the gas authorities were casting longing eyes in the direction of Gullane; but, whether from lack of enterprise or lack of funds, the idea of supplying gas from Aberlady to Gullane did not mature at that time. However, the scheme fructified later on, and he had pleasure in congratulating their President in having carried through the project. The value of the paper would be enhanced if the author could add a plan showing the district, the compressor house, and the mains in both Aberlady and Gullane. He might also suggest for the consideration of the President the introduction of a chart showing the pressure register in the high-pressure mains during the 24 hours, and also in the low-pressure mains. He (Mr. Gracie) would like to inquire what the price of gas was in Aberlady and Gullane. These figures would be useful in enabling one to decide whether it was a good financial proposition to supply high-pressure gas. He had been very much struck with the President's remarks in regard to the breakdown he had when the whole of the inside of the compressor was smashed to atoms. To have the compressor running again within a couple of hours was a very smart bit of work. It would be an advantage to have the compressor house at the works.

Mr. JOHN RICHMOND (Penicuik) remarked that there was a good deal to be said for the concluding paragraph of the address, wherein the President observed that it was not a paying proposition for a small works to supply high-pressure gas direct through reducing governors into low-pressure mains. In the circumstances, the ideal method of supply would be a district holder. This, however, had its disadvantages. In the first place, they would have, as Mr. Taylor had in Aberlady, the objections of the residents. Then a site had to be bought, and after the erection they found themselves burdened by the rating authorities with increasing taxation on the structural value, irrespective of the revenue derived. This put the idea of a district holder outside the realm of practical politics. Would it be better to discard the high-pressure distribution, and lay down a 6-in. or an 8-in. main at a cost of anything up to £5000? Supposing this money was borrowed at 5 p.ct., they would have no greater cost than at present, and certainly there would be a much more uniform supply throughout the district. In connection with the diaphragm trouble with the governors, he had observed another difficulty. He presumed these were under ground. On two occasions he had to cut out a 4-in. underground governor because of trouble with the discs. He believed it was much better to spend the money on an enlargement and supply at moderate pressures direct from the holders than to boost by mechanical means.

The PRESIDENT, in reply to Mr. Gracie, said the price of gas in Gullane was 6s. 8d. per 1000 c.ft. He could have brought the plans and drawings to the meeting, but he did not think the members would have time to look at them. Pressure charts had been taken since 1911, and these could be produced showing the pressure day and night for the full 24 hours. The gas engines were 300 yards away from the retort house. This was because the gasholder was erected first. As a matter of fact, the holder was built before the site for the gas-works was obtained. This explained why the compressor house was at the wrong side of the holder. If there were leaks in the main, and if the pressure was raised from 4 to 130 in., the leakage also rose correspondingly. In regard to what Mr. Richmond had said, he might explain that in Aberlady they were gradually putting in an 8-in. main. At Aberlady they had experienced no trouble with the valves of the governor sticking. The only trouble had been with rust; and this occurred in the first 300 yards or so of the main.

Mr. GEORGE BRAIDWOOD (Coatbridge) asked the President if he had considered the feasibility of putting in malleable iron pipes instead of steel pipes. Leakage naturally increased with distribution at higher pressures.

The PRESIDENT said the determining factor was largely the ground itself. There were so many bends in the road that they finally decided it would be wiser to lay steel pipes. The prices he obtained were for cast metal and steel. He did not go into the cost of malleable iron.

Mr. KEILLOR remarked that it was a pity that the President's address was so brief.

The PRESIDENT said he agreed that the address could possibly with advantage have been extended somewhat. The points that had emerged in the discussion would, he believed, add to the practical value of the contribution.

THE REALIZATION OF ECONOMY IN GAS-HEATED OVENS.

Mr. ARTHUR FORSHAW, M.Sc., Chief Chemist to Messrs. R. & A. Main, Ltd., Gothic Iron-Works, Falkirk, read a paper on "The Realization of Economy in Gas-Heated Ovens." This, with a report of the discussion, will be found below.

PRESENTATION TO PRESIDENT.

Mr. M'DONALD (Prestonpans) presented the President with the Association's gold medal.

Mr. TAYLOR, in acknowledging the kindness of his colleagues, said he was grateful to the members for the support they had given him during his year of office.

VOTES OF THANKS.

Thereafter, on the call of Mr. J. D. KEILLOR, votes of thanks were passed to the Committee, the Secretary, the Treasurer, and the Auditor for the arrangements that had been made for the meeting.

Luncheon was afterwards partaken of, and in the afternoon the members with their lady friends enjoyed a motor drive to Leith. There they joined a steamer, and cruised round the Forth Bridge and on to Aberdour *via* Inchcolm.

THE REALIZATION OF ECONOMY IN GAS-HEATED OVENS.

By ARTHUR FORSHAW, M.Sc., Chief Chemist to Messrs. R. & A. Main, Ltd.

My object in selecting cooker ovens as the subject of this paper is a twofold one. First, because a large amount of work has been done in the last few years in the direction of improving their design and construction. This makes primarily for reducing the original costs of manufacture, but the saving thus effected is mostly offset by the use of more costly and satisfactory materials and by the employment of more expensive devices for ensuring effectiveness and ease of working. In spite of this, it is a fact—at least so far as my own Company are concerned—that prices have been progressively reduced to the gas undertakings as the benefit of the new methods of production has been realized in the works. These improvements, which may be so far summed-up as the provision of a better article at an equal or less price, are, however, further characterized by the attention that has been given to the no less important side of the matter which is comprised in the word maintenance. All this work and its results as embodied in modern ovens are of interest.

Secondly—and I wish to deal more particularly with this—the gas industry and the gas apparatus industry have not been idle on the more scientific side, and a good deal of research has been done with a view to improving the performance of ovens in cooking operations. This has taken two directions—viz., to reduce the gas required to cook a given load, and to produce a better and more even cooking effect in a fully-loaded oven. In order to measure the progress made in research of this sort, some accurate form of test is required; and after a year's work, the Institution of Gas Engineers published a Report on the subject at the Annual Meeting last summer (June, 1924).

Owing to various causes, this report was not read *in extenso* at the meeting, and no discussion took place on its findings. It has therefore hardly attracted the notice which the importance of the subject warrants; and I propose to devote a considerable part of my allotted time to bringing its conclusions and their implications before you. This I feel the more confidence in doing since I was not only a member of the Committee that had the matter in hand, but actually myself carried out the experimental work on which the report was based.

Dealing with the report* first, a number of questions were formulated such as would inevitably occur to the mind of an intelligent purchaser of an oven. These are to be found in Appendix No. 8. Answers to these questions must be provided by the tests.

The first question I shall consider is No. 6, Does the oven heat up in a reasonable time? This is obviously the first consideration in the use of an oven. However, the question is not so simple as it seems; when we come to look at it closely we find that the information asked for is really, Does the oven become ready for, and able to perform, the initial stages of cooking operations within a reasonable time? We have therefore to define what is meant first by "heat up," and, secondly, by "a reasonable time." The first depends, of course, on the purpose for which the oven is required. It is also clear that, once adjusted to heat-up to a particular temperature in a given time, the oven, unless readjusted, will attain any other temperature in a longer or shorter time, according to whether it is a higher or a lower one. "A reasonable time" when expressed in minutes will therefore vary according to the particular foodstuff to be cooked.

After due consideration of the problem, it was realized that for any oven there is a normal maximum consumption which is defined as that maximum consumption which may be required for the initial stages of cooking operations. As the result of experience, it was further found that this consumption is

* Special Report of the Gas Investigation Committee, "Trans. Inst. Gas Eng.," 1923-4, "JOURNAL" for July 2, 1924.

not higher than such as will heat a packed oven up from cold to 400° Fahr. in 12 minutes, or an unpacked oven in 10 minutes. This does not mean that 400° Fahr. is the maximum temperature required for the initial stages of cooking operations, but that an oven which heats up at this rate is burning sufficient gas to perform the initial cooking stages of any foodstuff, and incidentally is heating up quickly enough to attain "in a reasonable time" any temperature that may be required.

I think you will realize that there is a fundamental difference between regarding the initial rate of gas consumption in an oven on the one hand merely as a means for the attainment of a temperature and on the other as a means for providing a sufficient source of heat for the initial stages of cooking. It is merely a fortuitous circumstance that the attainment of 400° Fahr. in 12 minutes, as shown on a thermometer, indicates, first, that there is a sufficient quantity of heat being delivered per second, and, secondly, that during the time interval between the lighting of the gas and the insertion of the foodstuff a further quantity of heat has been stored in the materials of the oven, both of which quantities together produce that effect already alluded to as the initial stages of cooking. It is this distinction between quantity of heat and temperature which accounts for the difference in time specified between packed and unpacked ovens in the heating-up Test (H), by which the normal maximum consumption is ascertained. In the unpacked type of oven less heat is stored up, and more is lost by radiation and convection from the outer surfaces. Consequently, to provide the requisite total, more has to come from the gas burned per second; and this results in a quicker attainment of the temperature as indicated on a thermometer. To make the point clearer without unduly labouring it, I may say that a much higher gas rate is required to attain 400° Fahr. in 12 minutes than to maintain that temperature steadily, and that if an empty oven were adjusted to the latter condition, and then a load of foodstuffs inserted, there might not be a sufficient quantity of heat available satisfactorily to perform the initial stages of cooking, though there would be sufficient to continue the cooking once the initial stages had been finished.

It will no doubt have occurred to you that, strictly speaking, various patterns of packed ovens will show some difference among themselves, just as there is a difference between packed and unpacked ovens. In point of fact, and under very closely regulated test conditions, this is so; but the difference is not sufficient to warrant the extra time and trouble that would be incurred by specifying any other conditions than those to be found in the heating-up test detailed in the report. In general it may be stated that, if the internal superficial area of the oven from the burner level upwards (including the bottom), expressed in square feet, be multiplied by 850, the product will give the number of B.Th.U. per hour required for the normal maximum consumption of a packed oven. If on making a heating-up test this quantity is found to be insufficient to enable the test to be passed, it may be confidently asserted that either the flue outlet is unnecessarily large, or the door and the various parts of the oven fit badly. On the other hand, if this quantity proves to be excessive, there is a probability that the flue outlet is on the small side. Either of these cases will be confirmed in the subsequent "factor of safety" test, for the former will pass the test by a big margin, whereas the latter will have difficulty in passing, if, indeed, it does so at all.

What I hope I have made clear to you up to this point is that for every oven there is a certain normal maximum consumption of gas which is sufficient to perform the initial stages of cooking operations (such as "sealing the joint" or "killing the yeast"), and that this consumption may be ascertained with a sufficient degree of accuracy by means of an empirical heating-up test.

My next point is that, in general, ovens are set to burn considerably more gas than the normal maximum consumption. This results from several causes. For instance, oven design has remained practically unaltered for thirty or forty years. In those days gas was much richer and was supplied at very much lower pressures, with 1-in. water gauge as a maximum. In order to give a satisfactory flame and burn sufficient gas under these conditions, or possibly to make an imposing show, burners were made large. With the gradual substitution of gas of poorer quality and at higher pressure, the burners remaining unchanged, consumers and fitters have become so used to high initial consumptions and long flames that they do not feel satisfied with anything less. So much is this the case that even at the comparatively low pressure of two inches (the legal minimum pressure of supply) many ovens will be found capable of heating-up to 400° Fahr. in so short a time as three to five minutes. Apart from its effect on the factor of safety, which I shall discuss later, this setting is obviously causing direct waste of gas. The usual instructions issued by its makers are that an oven should be lighted and left full-on for from 15 to 20 minutes before it is used for cooking; and there is no doubt that even this period is often exceeded. In such circumstances any rate of consumption over and above that of the normal maximum consumption means waste of gas—and waste at such a rate as cannot be made good by the utmost attention, either previously on the part of the maker to devices making for economy, such as insulation, or subsequently on the part of the consumer during the actual cooking operations. It is therefore necessary for the sake of economy to make sure that oven burners are set to give no more gas than is required for the normal maximum consumption, irrespective of the size and appearance of the flame. In an oven provided with correctly-designed gas and air adjustments, there is no manipulative difficulty in doing this. The difficulty, if any arises, is in persuading the fitter and the consumer that a flame so reduced is capable of doing all that is required.

The Factor of Safety.

The next question in the report which presents itself for discussion is No. 1: Does the oven smother? This is another of those apparently simple questions which on examination prove to contain much food for argument. Reduced to its essentials, it means, Does the oven become dangerous? We are then faced with the necessity of defining what is meant by "dangerous," and in what circumstances such danger is to be apprehended.

Provided an oven be well designed and correctly adjusted, the possibility of "smothering" arises through alterations to the pressure in the mains. An oven set to its normal maximum consumption at the minimum district pressure, as laid down in the report, will obviously consume more gas if and when the pressure of supply increases. After widespread inquiries and exhaustive discussion, the report laid down that an oven which can consume safely such an excess of gas over the normal maximum consumption as will result from a pressure increase of 2½ times the minimum district pressure will have a satisfactory factor of safety. An increase of this magnitude will result in an increased consumption of approximately 60 p.ct. The test for ascertaining that the oven has a satisfactory factor of safety is called the smothering test (S).

In dealing with the previous question, the heating-up test for ascertaining the normal maximum consumption is done on an oven as received from the maker with no attempt to improve its performance by sealing or luting-up with cement any of the joints or door cracks. This is specified in the details of the test because the oven is then in its worst state from the point of view of heating-up. As it becomes older in use, the cracks and so forth tend to become filled-up by grease and the like, and its performance will improve. For this same reason it is specified that, in ascertaining whether the oven has a reasonable factor of safety, it shall be luted-up round all joints with cement, for this is its worst state for safety, and one to which it approximates when in use.

The whole significance of the smothering test rests on the definition of smothering. This is given in the report as taking place when two or more flames permanently leave either or both burners. A long Appendix (No. 5) is devoted to a discussion of floating and smothering. The important point to remember is that smothering, as defined above, is in itself not dangerous. When the point is reached at which two or more flames permanently leave either or both burners, it is an indication that the limit of safety is reached. Increasing the consumption of gas beyond that already being used would soon bring the appliance within the danger zone, where one burner would become completely extinguished. It is worth pointing out that, even when this latter state is reached, the gaseous contents of the oven are obviously incombustible until they receive a further supply of air, and, therefore, that so far as a state of danger exists, it may be described more as a possible than as an actual one. It is, further, one which should be speedily detected by the smell of unburnt gas. However, the point I wish to make plain here is—and the report makes it very plain—that for purposes of the test the limit is reached when flames are actually extinguished, and that lengthening, wavering, or floating of the flames is not the criterion. I mention this point particularly because I have met those who became needlessly alarmed at the slightest evidence of alteration to the length or aeration of the flames. I may say that in ovens with top flues high thermal efficiency is invariably characterized by lengthening of the flame when the normal maximum consumption is increased by 60 p.ct., as required in the smothering test; and that so long as the directions with regard to luting the joints have been carried out, and so long as no flames are permanently extinguished, such an oven is perfectly safe in use, in spite of its lengthened flames. The smothering test put forward is, in fact, a stringent one; and I should imagine that very few gas engineers would feel satisfied if their distribution pressure varied between as much as 2 and 4½ in. water-gauge. This is the *minimum* permissible difference between the heating-up and smothering tests; while where the district minimum pressure is higher than 2 in., this difference, with the unlikelihood of the oven ever reaching the smothering point, becomes greater still.

I remarked in discussing excessive initial consumptions of gas that they had an effect on the factor of safety. This effect will now be obvious; for if ovens must be made to stand such initial consumption, they must also have sufficient flue outlet to pass the smothering test, in which some 60 p.ct. more gas is to be consumed. The result is that when, after the initial cooking stages, gas is reduced, the flue outlet is so large that a con-

siderable quantity of air is drawn through the oven by the "chimney effect" of the heated space. This air not only performs no useful function, but is a positive disadvantage, for it removes what would otherwise be useful heat, and so reduces the thermal efficiency of the oven, with the result that the gas required to perform any cooking operation is increased.

The next question from the report is No. 4: Is the oven economical in gas consumption? I have dealt with certain aspects of economy from the point of view of the initial stages of cooking; but this question refers to over-all economy, and the tests so far discussed do not deal with it.

It is manifest that over-all economy—or, rather, that part of it concerned in the cooking after the initial stages are complete—is principally a question of heat insulation. Other things being equal, the better insulated oven requires less gas to maintain a cooking temperature. It is none the less true that, even were a perfect insulator to be discovered and employed, its effect on economy might be completely destroyed if it were built into an oven which had an unnecessarily large flue or one in which the construction was so imperfect that gaps and cracks existed through which hot air and products of combustion could escape. To meet the demand for knowledge on this side of the subject, the report specifies the temperature maintenance test (M). Briefly described, the test consists in heating-up the oven to a temperature of 350° Fahr. above that of the room. This temperature is then maintained steadily; and when the gas required for this has reached a constant rate per hour, the average temperature of the oven is found by means of a number of thermometers. The heat units required for the purpose are divided by the internal superficial area of the oven; and thus a comparative figure, expressed in B.Th.U. per sq. ft., is obtained. The lower this figure, the better the oven.

Carefully carried out, this test is very sensitive, so much so that the difference between, for instance, an oven with a badly fitting door and the same sealed with clay can be easily determined, as can also the difference caused by slightly increasing the thickness of insulating material or an alteration to the size of the flue outlet. In fact, the effect of any alteration to the construction of the oven is immediately apparent in the result of the test.

As the result of this sensitiveness the test is a very useful one, especially for the maker, as it enables him to decide as to material, details of construction, and so on. I must point out, however, that while it should be applied by a gas undertaking to the oven as received by the maker and without sealing any joints, for that is the worst condition, yet, if there is any attempt to compare the effect of flues or of insulating material, the ovens in question should then be sealed in all joints, including the door, in order to eliminate leakage of products, which would introduce factors of unknown magnitude, and thus vitiate the immediate results sought for.

It must also be pointed out that, for the sake of convenience, all the heat losses, including flue loss, are reckoned in the result as heat loss per sq. ft. of surface. Actually, the loss through the flue is greater than through the walls. No disadvantage is suffered by this procedure, since there would be no particular gain in being able separately to assess the two losses, while any increase in efficiency obtained by alterations to a flue is clearly shown in the improved figure for heat loss per sq. ft.

I now proceed to the remaining questions in Appendix 8—viz.:

2. Does the oven consume sufficient gas to cook in a reasonable time?
3. Is the distribution of heat sufficiently uniform to allow of a full load of food being cooked with the least number of changes of position of food? If not, how many changes are necessary to avoid burning?
5. What percentage of the total space of the oven is available for cooking?
7. Is the oven as efficient when used quickly as when used more slowly?

With regard to No. 2, it is clear that, if the oven will heat up quickly enough, it will also burn sufficient gas to cook in a reasonable time, so that no special test is needed after the H test. Nos. 3, 5, and 7 cannot be answered by the results in the H, S, and M tests.

With regard to No. 3, it is true that the distribution of temperature in the empty oven is found during the M test, but as this distribution is entirely altered so soon as solid shelves or tins containing food are placed in the oven, the readings obtained in this test are no criterion of the distribution during actual cooking. Even were they reliable, they would give no answer to the latter part of the question—viz., how many changes of position are required to prevent burning of food.

With regard to No. 5, it is also true that the percentage of cooking space contained within the gates or hangers and the lowest shelf position may be measured and expressed as a percentage of the total oven space; but obviously what is asked for is the space in which cooking may be carried on satisfactorily, and the two are not necessarily coincident.

No. 7 requires re-stating, for an oven used slowly—that is, at a lower temperature—will naturally lose less heat, and will in that respect be more efficient. The question really means, Is the oven as effective as a cooking agent when used slowly?

A short consideration of these three questions leads to the conclusion that an actual cooking test is required in order to find answers to them. The report therefore puts forward for this purpose the bread baking test (Cb). Again, without going into the great detail necessary in the report, I may say that this test consists in heating up the oven at the normal maximum consumption to a definite temperature; and when this is attained, of placing in it a weight of dough proportional to the cooking space as provided by the maker. The oven is then adjusted to burn gas at a given rate, based on the gas required to maintain the empty oven at 350° Fahr. above the room, as found in the previous M test. During the baking the loaves will probably require their position changing in order to ensure equal browning over the whole batch. If the oven does not require such attention, it is clearly a better oven than one which does require it.

At the conclusion of the bake the loaves should all be ready at once and all equally browned. It is intended that two or more ovens shall be tested at the same time, as the results are to be comparative not only in gas used and time taken, but in general appearance of the bread.

The first differentiation between ovens will be in this last respect. If there is no difference in the quality of the product, the test is repeated at progressively higher consumptions until either there is such a differentiation or until so high a rate of gas is used that baking is completed in 45 minutes, which is as quick an operation as is desirable. It is not expected that this short time will be attained with the large load specified. If, however, some ovens are able to bake their load equally and satisfactorily in this time, they are compared for total gas consumed per pound of bread produced (*i.e.*, heat units per pound). Usually there will be a marked differentiation before this consumption is reached. In some cases it has been found that loaves burnt before they browned, even at the first test. This is usually an indication that the cooking space provided by the maker is too large a percentage of the total space, and that sufficient side space has not been left for the ascension of the highly-heated stream of products of combustion immediately over the burners. Such results usually occur with ovens in which the grid supports are integral with the sides.

Bread is used in these tests because, if it can be baked satisfactorily, so can anything else; and further because, with proper precautions, dough can be obtained of a consistent quality more easily and cheaply than most other foodstuffs.

It is as well to repeat that this bread baking test is not what is usually called a "scientific" one, by which I mean one where results can be expressed in some unmistakable physical or mathematical units. It is a practical test made as "scientific" as possible by attention to the details and by controlling the variable factors. In assessing the results, gas used, time required, evenness in baking, and reduction in the number of changes of position of the loaves—if that be possible—have all to be taken into consideration. The fact is that, in taking an unprejudiced view of the factors which govern oven construction, we must recognize that they must come under one of two heads—viz., efficiency or convenience. Efficiency means the realization of economy. Convenience must be further subdivided into three parts—viz., for the maker, so that his production is facilitated; for the gas undertaking, so that maintenance, which comprises renewals, repairs, and adjustments, is reduced to a minimum; and for the user, so that cooking may be carried out with the least possible trouble and attention, and the subsequent cleaning be made easy.

It is the makers' task so to design and construct an oven that all these factors are given due consideration. The resulting oven must clearly be in the nature of a compromise, as it is hardly possible to embody in one product the maximum efficiency and the maximum convenience for all the three interests mentioned. The most outstanding instance of the necessity of compromise between efficiency and convenience that occurs to me at the moment relates to the hotplate. For many years drilled ring burners placed under straight iron bars represented the best practice in hotplate construction. Its principal merit was its convenience, particularly to the consumer, for it allowed utensils to be moved about with ease; the smallest pan or teapot or even a cup would stand upright on the first spot on which it was placed, and, not least, the minimum of labour was required for cleaning the bars. Where it fell short was that, as an apparatus for transferring heat from burning gas to the contents of the utensil, the over-all thermal efficiency was low. You are all familiar with the activities of various makers during recent years to remedy this failing. I do not wish to discuss this matter in detail, as it is merely brought forward as an illustration of the necessity for balancing efficiency against convenience. I will therefore only say that, whether the result of these activities took the form of the so-called "high efficiency" burners, or whether drilled burners were retained, in either case the burner was placed under a shaped bar of cast iron, and the effectiveness of the combination depended on the care with which the bar was designed in order to keep it as far as possible from contact with the flame or even with the hot products of combustion flowing from the flame. By this means very much higher thermal

efficiencies were realized, but, on the other hand, those points of convenience noted above, which were characteristic of the old arrangement, were found to a great degree lacking. It is my experience that a year or two must pass after the first putting on the market of apparatus embodying new ideas before the real trend of public opinion on them filters back to the maker. On "efficiency" bars that opinion is now to hand, and it is to the effect, if I read it aright, that, while the housewife or the cook does not object to efficiency, which she is told she is getting, yet it is to her a nebulous and intangible abstraction compared with the practical facts that when she puts the teapot on the new bars she dare not let go until she has "wasted" a few seconds making sure that it will "stay put," and that when she wants to clean them they are so full of cuts, gaps, and projections that the cloth will not slide along them. At any rate we are now respecting this opinion to the extent of providing bars that are a compromise. They afford a high efficiency compared with the old bars, though not so high as that of our other or ultra-efficient type; at the same time they are essentially smooth and without projections on the upper surface, thus allowing of easy cleaning and convenient placing of utensils without fear of accident.

To return to the consideration of ovens, I have already given some mention to the matter of economy during the initial heating period. A further aspect of economy is that concerned with the main cooking period after the initial stages are completed. In order to develop the subject, it is necessary to know what changes we desire to effect in the foodstuffs during the main cooking period, and, therefore, what temperatures are necessary in the oven for the purpose. Without going into wearisome detail, it is sufficient to say that, with the possible exception of one or two special articles of confectionery, which require a short exposure to a comparatively high temperature, high temperature is not required for any other purpose than that of browning the outer surfaces of the food. The actual changes in the chemical or physical state of the interior of the food are all completed below the temperature at which water boils, and, contrary to the general opinion, foodstuffs in an oven are not actually cooked at a constant temperature, but from the start to the finish their temperature is rising. The rate at which the temperature in the food rises clearly depends on the difference in temperature between the food itself and the hot gases surrounding it, and, further, on the conductivity of the food substance for heat. If heat be supplied too quickly for the surface of the food to absorb and pass it on to the centre, the outside will brown or burn before the inside is done. If too slowly, the food never browns and is not appetising. Between these two extremes there is a great number of possible rates of heat supply, or—to use the ordinary way of expressing the idea—of possible oven temperatures, at which cooking will proceed, one or other of which is found by experience to suit the preference of a particular household. For this reason the lists of temperatures put forward from time to time as the correct ones at which the various foods enumerated should be cooked must be used with the greatest reserve, particularly as it is next to impossible to determine the temperature of an oven during cooking. Oven thermometers, as usually supplied, must be looked on, after careful watching and checking during actual cooking, as useful indicators of the suitability of the oven for various cooking operations, but no reliance can be placed on them for showing the temperature at which the cooking proceeds. As a matter of fact a chart (fig. 10) given in the report already referred to, shows that during bread baking the temperatures indicated by thermometers in the centre of the oven and at three different levels rise regularly throughout the baking period, and, though about 430° Fahr. is usually given as the temperature required in the oven during the baking of bread, the highest temperature reached by any of the three thermometers is 415° Fahr., in spite of which three loaves were perfectly baked in 50 minutes. The bread itself during this time showed a gradual rise for the first 30 minutes and a rapid rise thereafter to a maximum of 206° Fahr., at which it was removed from the oven.

During the same series of experiments, details of which are to be found in Table 3, bread was baked in times varying from 42 to 113 minutes and at gas rates varying from 590 to 1020 B.Th.U. per sq. ft. of internal oven surface per hour. The total consumption of heat, starting all cold, varied from 760 to 1990 B.Th.U. per lb. of bread baked. That such variations are compatible with properly-baked bread has been amply confirmed to me since by the chemist at one of the largest bakeries in Scotland. There the time for baking varies in a similar manner according to the particular type of oven used.

All these experiments and this information bring me to the conclusion that, just as economy can be achieved in the preliminary heating up and in the initial stages of cooking by attention to the flue outlet and to the gas consumption, it may be attained in the main cooking operation by similar means; and in my opinion this possible economy is neither sought for nor realized in the great majority of cases. Too much gas and unnecessarily high temperatures are used by the consumer.

Though the figures quoted above all refer to bread baking, yet I am convinced that a similar inquiry directed to meat and so on would show similar results. Indeed, we have only to reflect that practically all foods may be cooked satisfactorily, so far as palatability and digestibility are concerned, or even overcooked in boiling water, to realize that very much lower temperatures may be used than those ordinarily recommended. So long as the difference in temperature between the hot gases and the food is sufficient to cause a flow of heat into the latter up to the point at which meat, for instance, attains an internal temperature of something over 180° Fahr., the main cooking operation will proceed satisfactorily.

Cooked at a low external temperature and more slowly, meat is more nutritious and more easily digested. There only remains to be mentioned the characteristic brownness and crispness of the surface which add to the appearance and palatability of baked meat. Even should these not be normal concomitants of meat baked at low temperature, they could easily be brought about by what I might call a final stage of cooking for a comparatively short time at an increased gas rate. Be that as it may, I am sure that a fair proportion of the gas at present consumed for cooking in ovens is used to no necessary purpose, and that the experiments made on baking bread and the general considerations I have advanced show that this proportion could be saved by due attention to the various points involved.

I find that I have left myself very little time to deal with the ronstructional side of gas ovens. I shall therefore have to restrict myself to a short description of the principles of our latest production. So far as the actual constructional details go, I shall have to ask you to take for granted that the cooker embodies all the characteristic features which we have made a *sine qua non* in all our productions—I refer, of course, to simplicity, interchangeability, and general features making for reduced maintenance costs.

Its design, however, is different from our other ovens. The idea was brought to our notice by Messrs. Thomas Glover and W. H. Wayte, of the British Gas Light Company, Norwich, to whom credit for it is due. In putting the idea into practice we provide an inner lining, which may be either removable or fixed. In either case it forms an internal unit which contains the usual oven furniture and receives the products of combustion from the gas. The products do not pass straight through the oven space and escape at the top of the unit, but after circulation in the unit they make their way through a slot placed near the bottom and extending across the whole of one face of the unit. This slot gives them access to the space between the inner unit and the outer casing of the oven, through which space they ascend to the flue outlet, which is conveniently situated in the usual position.

The principal features of this design are that economy is promoted because, first, by causing the products of combustion to circulate, instead of passing them straight through from bottom to top, they are clearly enabled to give up more of the heat they carry to the food in the oven; second, because, whatever the "pull" on the flue outlet, cold air cannot be drawn through the cooking space and carry away heat; third, owing to the circulation, the temperature gradient between top and bottom of the cooking space is made much less steep than in an ordinary oven, and consequently the whole of the space is made available for cooking, down to within a short distance of the flames; fourth, because cooking proceeds more evenly, and there is less possibility of burning food.

That the above remarks are no mere unsupported opinion will be clear when I say that at present approximately a thousand of these ovens are in use and have been closely watched. It is gratifying to our collaborators and to ourselves to know that letters of appreciation of their good qualities and performance continue to be received. What is more, the new oven has been instrumental in converting the proprietor of a large restaurant from the use of electric ovens to gas, of which he was formerly an opponent.

From the gas undertakings' point of view the peculiar merit of this invention is that a similar unit may be applied to any existing oven, which is thereby brought up to date at a comparatively low cost. In addition to this I may say that, where the new oven itself is preferred, all its parts, with the exception of those belonging to the actual unit, are fully interchangeable and standardized with those of our present cookers. The gas undertakings are thus provided with cookers designed to give perfect cooking with the utmost economy and ease of working, and with these advantages the further important one—already mentioned—of interchangeability with existing cookers.

In conclusion, I wish to point out that the subject of economy is one in which the average consumer is at present practically uninstructed, and that, so far as the manipulation of a gas oven is concerned, there is so much latitude permissible in the setting of the burners and so forth that, unless the user receives some instructions through the undertaking which supplies the appliance, little improvement is to be looked for. However well-designed an appliance may be for the realization of economy, it is ineffective towards this end unless it is used with an intelligent appreciation of its possibilities. The first step towards this is, in my opinion, the instruction of the fitters and inspectors who come into contact with the consumers; and, as I have indicated, some of the ideas held at present—a legacy of the past—require revision. It has been my endeavour to show, so far as possible in a short paper such as this, in what direction economy may be attempted; and while thanking you

for this opportunity of laying my views before you, I shall feel gratified if they provoke useful expression of opinion from those of you who have practical experience of the problem.

Discussion.

Mr. H. H. GRACIE (Edinburgh) thought the members would admit they were indebted to Mr. Forshaw for an excellent paper. It was quite a scientific treatise the author had given them; and he might put the members still further in debt to him if he undertook to prepare a short digest for the use of fitters and maintenance men in the industry. If the paper could be compressed into short compass, it would reach a very much larger section of the workers, while it might also reach a large number of the public, who were always deeply interested in the question of economy, but did not know exactly what to do in order to effect it. He did not know if Mr. Forshaw was in a position to tell them the highest efficiency he had been able to obtain from a gas oven under the very best conditions. This was rather an important point, and one with which a number of experimenters had been dealing for a considerable time.

Mr. FORSHAW thought Mr. Gracie's idea of a digest for the use of fitters, and possibly consumers as well, was an excellent one. As a matter of fact, he had that in his mind, because the report to which he had alluded in the paper—the Institution Report on the standard method of testing gas ovens—would hardly reach the people for whom it was intended, unless a digest was prepared. The report itself was a voluminous thing. There was a lot of detail in it; and one feared that, when information was wanted, people would not take the trouble to search for it, and dig it out of the report. For this reason he would personally have pleasure in preparing a digest. A question had been asked regarding efficiency; and in the report of the Institution a number of interesting figures were given. Taking it all round, unpacked ovens would maintain a temperature of 350° above that of the room with the expenditure of somewhere between 600 and 700 B.Th.U. per sq.ft. per hour. Packed ovens ran from 400 to 550; and the 550 one happened to be an oven with a large flue. When the flue of that particular oven was altered, they got a figure of 450. That was to say, they reduced by 100 B.Th.U.—a fifth or more of the total—simply by reducing the flue. Moreover, they did not spoil the purpose of that oven by reducing the flue; and they did not render it unable to pass the smothering test. With regard to the efficiency of bread-baking, there was a tremendous lot of information in the report; but it was rather difficult to epitomize it. For instance, they got figures of about 900 B.Th.U. for a pound of bread. Some figures gave an even higher efficiency than this; but they were figures which represented the very best practice. In all, they tested eight different sorts of ovens; and in the largest ovens they had the best results. These, however, were not quite the ovens that the ordinary consumer would use.

Mr. JOHN RICHMOND (Penicuik) remarked that the paper, besides being scientific, was argumentative and logical. One conclusion to be drawn from it was embraced in the paragraph where the author admitted that the oven would be capable of heating-up in five minutes, while he gave twelve minutes as the period with normal maximum consumption. The whole thing appeared to centre around the manipulation of the oven. There was now an automatic regulator attachment which was fitted on to gas ovens, and to a great extent did away with dependence on the human element.

Mr. FORSHAW said he purposely refrained from saying anything about the automatic regulator, because in his opinion it deserved to have a paper all to itself. Mr. Richmond said something about heating-up in twelve minutes; but he did not quite follow him on that point. If they insisted on heating-up in five minutes, the consumer would leave it longer than the stipulated time, and thus waste gas. There might also be a larger flue outlet in order to pass the smothering test. The consequence was that more gas would be lost in the actual cooking operation by air being drawn through the large outlet and taking away the heat that would otherwise be used.

Mr. R. W. COWIE (Port Glasgow) thought it would be generally admitted that there had been more improvements in gas cookers within recent years than had been the case for a long time previously. The oven was now not so deep, and it had been considerably widened. This, to his mind, was a great advance. Sometimes housewives demanded that the oven flue should be connected to the chimney, so that the smell of what was being cooked was not carried through the house. Personally, he preferred to leave the oven unventilated, rather than stick it into the chimney. Frequently there was a considerable draught in the chimney, which greatly reduced the efficiency of the oven. Then he considered that cookers which were raised from the floor were a great improvement.

Mr. FORSHAW said that he, too, liked the wider oven. Whether an oven was big or small, it should have the same depth. His argument was that there ought really to be a standard depth for all ovens. Two or three years ago he wrote an article that appeared in the "GAS JOURNAL," in which he advocated that the only difference between ovens should be in width. The bigger oven ought to be a wider oven, but it should not be any higher or deeper. Of course, the flue-pipe question was a very big one. Personally, he thought it was necessary to have flue pipes to ovens from the point of view of fumes and the smell of the food.

A vote of thanks was accorded the author, on the motion of the PRESIDENT.

GAS ENGINEERS AND MANCHESTER'S LORD MAYOR.

A Trip on the Ship Canal.

Members of the Manchester District Institution of Gas Engineers, to the number of 120, had an unusual but extremely pleasant outing last Friday. They were the guests of the Lord Mayor of Manchester (Alderman F. J. West), and as such were privileged to see something of the Manchester Ship Canal Company's Docks, with their wonderful equipment for speedy unloading and loading of ships, and then to sail along the great waterway from Manchester to Eastham, and thence on the Mersey to the landing stage at Liverpool. It was an experience which will not soon be forgotten. No one could take part in it without thinking that it was only a big-hearted man like the present occupant of the civic chair in Manchester who could devise such a plan for enabling his fellow members of the Manchester District Institution of Gas Engineers to forget for a while the fret and worry of business.

The start was made from the Pomona Dock, which is on the Manchester side of the canal, just before 10 a.m. The Lord Mayor welcomed his guests on board the good ship "Claughton." How highly the trip was esteemed was shown by the fact that a large proportion of the company had come long distances. The Lord Mayor, who is a representative of the Manchester Corporation on the Directorate of the Canal Company, was accompanied by Mr. Ernest Latimer, Managing Director of the Company, and Mr. F. A. Eyre, the Secretary. Among the guests were the President of the Institution, Mr. F. H. Robinson, and Mr. W. Rogerson, the Secretary.

A few minutes after the vessel had left the wharf side the visitors saw the first of the engineering wonders for which the Ship Canal is noted—the working of the Trafford Swing Bridge, which carries the road and the tramways over the canal. Entering the largest of the docks, the visitors disembarked for an inspection of the dock, sheds, and equipment, after which they proceeded along the waterway for 35 miles.

When about midway between Manchester and Liverpool, luncheon was served; the Lord Mayor presiding. Mr. Robinson, President of the Institution, proposed the health of the host, the Lord Mayor of Manchester. Subsequently he proposed "Success to the Manchester Ship Canal." The toasts were received with enthusiasm. The Lord Mayor responded in a few appropriate words, remarking that he was more than delighted to have had the pleasure and privilege of receiving so many of his fellow members for a sail on Manchester's great waterway.

The voyage ended at Liverpool. The weather, if a little dull at times, was fair all the way.

PHYSICAL AND CHEMICAL SURVEY OF THE NATIONAL COAL RESOURCES.

The North Staffordshire Committee.

One of the main functions of the Fuel Research Board of the Department of Scientific and Industrial Research is a survey and classification of the coal seams in the various mining districts by means of physical and chemical tests in the laboratory, supplemented where desirable by large-scale tests at H.M. Fuel Research Station, East Greenwich, or elsewhere. The Board have decided that the best way to carry out this work is by means of local committees representing the local colliery owners and managers, the local branch of the Institution of Mining Engineers, the Fuel Research Board, and the Geological Survey of Great Britain, as well as outside scientific interests. Each committee is charged with the duty of supervising the work of the physical and chemical survey in a coal mining area; and in this way the survey becomes of practical value from the commencement, since local knowledge and experience are made available, and the seams to be investigated and the general programme of work are decided by those who are able to estimate most correctly the relative importance of the problems to be solved. The seams selected undergo physical and chemical examination by local investigators appointed for the purpose, after which a final selection is made of those seams likely to justify experiments on a technical scale in order to test their suitability for particular uses or methods of treatment.

Committees have for some time been actively at work in the Lancashire and Cheshire and in the South Yorkshire areas.

The Board have recently appointed a Committee to deal with the survey in the North Staffordshire area. The North Staffordshire Colliery Owners' Association and the North Staffordshire Institute of Mining Engineers are co-operating in the work, and the composition of the Committee is as follows:

Representing the North Staffordshire Colliery Owners' Association.—Messrs. J. Cocks, J. Gregory, G. P. Hyslop, and E. P. Turner.

Representing the North Staffordshire Institute of Mining Engineers.—Mr. S. Henshaw.

Representing the Geological Survey of Great Britain.—Mr. A. A. Howe.

Representing the Fuel Research Board.—Dr. C. H. Lander (ex-officio), Director of Fuel Research; and Mr. F. S. Sinnatt (ex-officio), Superintendent of the Physical and Chemical Survey of the National Coal Resources.

INSTITUTION GAS RESEARCH FELLOWSHIP, 1925.

INFLUENCE OF THE ASH CONSTITUENTS IN THE CARBONIZATION AND GASIFICATION OF COAL, WITH SPECIAL REFERENCE TO NITROGEN AND SULPHUR.

Part I.—PREPARATION AND PRELIMINARY EXAMINATION OF SPECIAL COKES.

By C. B. MARSON, B.Sc., A.I.C. (Gas Research Fellow), and J. W. COBB, C.B E., B.Sc., F.I.C. (Livesey Professor).

INTRODUCTION AND SUMMARY.

In previously-published reports on the work of the Gas Research Fellowship (see references at the end of this section) dealing with the carbonization and gasification of coal and coke in different atmospheres, with special reference to nitrogen, sulphur, rates of gasification, and composition of gas produced, mention has been made of the more than possible influence of the inorganic ash constituents on the results. That is now our subject. If the influence of ash is found to be considerable, it is of high scientific and practical importance, because the ash varies so much, in both quantity and quality, in coals, because it is a constituent which can often be lessened to a considerable extent by washing and grading, and because, if sufficient reason could be shown for such an unusual proceeding, an addition of a desirable ash constituent could be made to a coal, particularly if the coal were finely divided, either naturally or by grinding, for blending or briquetting. Lime has been so added in the past.

The variety in the quantity and composition of ash in different coals, and the number of compounds present in any one ash, make it a thankless task to attempt to draw conclusions from the comparative examination of a number of existing coals at this stage. The simplest plan would be to begin by incorporating with an ashless coal single oxide constituents commonly occurring in coal ash, and to determine the influence of each addition; but no coal is ashless. The closest practicable approximation to this method appeared to be to choose a coal with as little ash as possible, and add to it an amount of each oxide, which would at any rate make it the quantitatively dominating inorganic constituent present. Through the kindness of the New Sharlston Colliery Company, we were supplied with a coal containing less than 1 p.ct. of ash; and we made 5 p.ct. additions of such oxides as silica, alumina, lime, and ferric oxides, or equivalent quantities of other compounds such as carbonate. Dr. Lessing, who has appreciated the importance of this subject for many years, and has recently published a paper entitled "The Influence of Catalysts on Carbonization"[1], made some useful experiments by adding various compounds to sucrose and cellulose before carbonizing them; but this method was not open to us, because of our special interest in nitrogen and sulphur compounds present in coal, but not in sucrose and cellulose, apart from the difference between the organic matter in them and the coal substance.

Our work divided itself naturally into two stages; the first being the preparation of the special "impure" cokes, and the second the behaviour of the cokes so prepared compared with one another and with the "pure" cokes made by the coking of the coal without addition. In this report we deal mainly with the first part—*i.e.*, the preparation of the cokes, and their composition and properties, particularly as influenced by the various additions. Each coke was prepared at two temperatures, 500° and 800° C., representing, respectively, low and medium temperature carbonization; five to six hours being the period of heating.

The most remarkable changes in the physical character of the cokes were brought about by oxide of iron and alkali. The "pure" coke—*i.e.*, made from the coal without addition—was very spongy and swollen. It was from a "gassy" coal. The oxide of iron coke was much smaller in bulk, more compact in structure, finely porous, and much more resistant to crushing (Table 2), though it was easily rubbed down, and the specific gravity of the coke material, apart from added oxide, was no higher than that of the "pure" coke made from coal without addition. The influence of alkali (soda) depended on the form in which it was supplied. Caustic alkali (sodium hydrate) simply destroyed the coking quality, while sodium carbonate gave a compact, finely porous coke, particularly resistant to crushing.

The difference in appearance of the special cokes, as obtained in the crucible test, is illustrated in Plate 1.

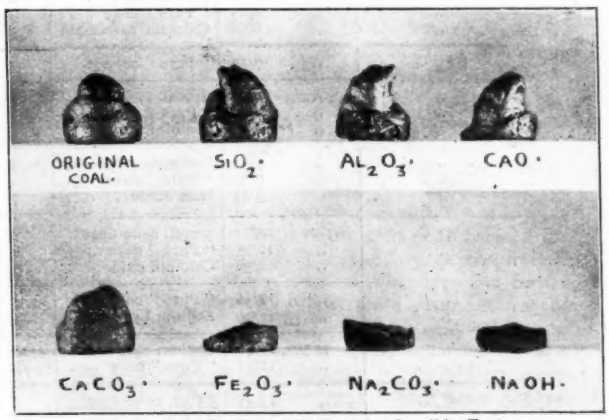


Plate 1.—Coke Buttons Obtained in Crucible Tests.

The influence of the additions on nitrogen, sulphur, and other constituents may be seen from Table 1. Iron oxide, lime, and alkali were all of importance in this connection. As regards physical structure and chemical composition, the effects of alumina and silica additions were not noticeable.

Iron oxide and, less decisively, lime and calcium carbonate lessen the nitrogen left in the coke prepared at 800° C., while sodium hydrate and carbonate increase it; but these effects are not noticeable in the cokes prepared at 500° C. They are not low-temperature effects. The other oxides are without influence. The nitrogen content of the "pure" coke is somewhat lowered by preparation at 800° instead of 500° C.

With sulphur the position is that iron oxide, lime, sodium hydrate, and sodium carbonate—probably in the descending order named—increase the sulphur left in the coke prepared at 800° C.; iron oxide and lime being also effective, though to a less extent, at 500° C. The influence of other compounds is small. The sulphur content of the "pure" coke is slightly lowered by preparation at 800° instead of 500° C.

The "sulphide" sulphur (easily decomposable sulphides not present in the coal, and therefore formed in the carbonization process), is produced in some quantity at 800° C. by lime (particularly), sodium hydrate, sodium carbonate, calcium carbonate, and iron oxide, and at 500° C. by lime. The increase in "sulphide" sulphur by lime at 800° C. is sufficient to account for the increase in total sulphur. Other oxides and compounds have little effect.

Conclusions from the percentages of volatile matter left in the cokes after carbonization at 500° or 800° C., but expelled in the ordinary crucible determination of volatile matter at about 900° C., are difficult to draw, because of the presence of carbon dioxide, undetermined in amount. It does seem plain, however, that in the iron oxide 500° C. coke the volatile matter is distinctly higher than in the "pure" coke, while this difference is practically eliminated in the corresponding 800° C. cokes. This would suggest that in some way the expulsion of volatile matter below 500° C. has been hindered by the oxide of iron. Since that is the stage in which the form of the coke is determined by the action of escaping gas on the plastic mass, the difference between the compact and finely porous iron oxide coke made at 500° C. and the spongy "pure" coke may be traced to this proximate cause, whatever its ultimate explanation, on which we are

TABLE I.—*Analyses of Prepared Cokes (Ash Free Basis).*

Temperature of Preparation.	Sample No.	Description.	P.Ct. Ash.	Calculated on Ash Free Basis. P.Ct. Loss at 105° C.	P.Ct. Vol. Matter.*	P.Ct. Fixed Carbon.	P.Ct. Nitrogen.	P.Ct. Total Sulphur.	P.Ct. "Sulphide" Sulphur.†
—	—	Original Coal.	0·88	2·5	34·5	63·0	1·86	0·87	*Nil*
500° C.	Series 1. 3/15	Silica	6·5	3·2	13·1	83·7	2·00	0·79	0·006
,,	,, 3/16	"Pure" coke . .	1·0	3·0	11·8	85·2	1·90	0·69	0·008
,,	,, 3/17	Aluminium oxide .	7·2	3·2	12·6	84·2	2·08	0·64	0·004
,,	,, 4/18	Calcium carbonate	8·1	3·8	12·3	83·9	1·81	0·59	0·007
,,	,, 4/19	"Pure" coke . .	1·0	3·3	11·1	85·6	1·87	0·61	0·006
,,	,, 4/20	Iron oxide . . .	6·7	4·3	17·2	78·5	1·88	0·86	0·007
800° C. (2 hrs. to heat up)	,, 5/21	Silica	7·7	4·0	3·4	92·6	1·67	0·61	0·007
,,	,, 5/22	"Pure" coke . .	1·3	4·2	3·1	92·7	1·58	0·66	0·004
,,	,, 5/23	Aluminium oxide .	8·2	4·5	2·6	92·9	1·69	0·56	0·004
,,	,, 6/24	Iron oxide . . .	8·0	5·3	4·9	89·8	1·32	1·10	0·013
,,	,, 6/25	"Pure" coke . .	1·3	4·2	2·7	93·1	1·73	0·59	0·006
,,	,, 6/26	Calcium carbonate	8·8	3·7	7·2	89·1	1·65	0·72	0·089
800° C. (3 hrs. to heat up)	,, 7/27	"Pure" coke . .	1·1	3·5	2·6	93·9	1·72	0·62	0·007
,,	,, 8/28	Silica	7·2	4·3	2·8	92·9	1·69	0·63	0·005
,,	,, 8/29	"Pure" coke . .	1·3	3·7	2·9	93·4	1·67	0·57	0·005
,,	,, 8/30	Aluminium oxide .	7·8	3·2	2·7	94·1	1·75	0·60	0·010
,,	,, 9/31	Calcium carbonate	8·8	3·9	6·3	89·8	1·40	0·70	0·11
,,	,, 9/32	"Pure" coke . .	0·9	4·0	3·0	93·0	1·79	0·65	0·004
,,	,, 9/33	Iron oxide . . .	7·5	4·0	3·1	92·9	1·35	1·06	0·16
500° C.	Series 2. 10/34	5 p.ct. coke dust .	1·1	1·9	8·4	89·7	2·09	0·73	0·008
,,	,, 10/35	"Pure" coke . .	0·9	1·6	9·0	89·4	2·19	0·71	0·008
,,	,, 10/36	Calcium oxide . .	7·7	1·3	11·0	87·7	2·13	0·96	0·126
,,	,, 11/38	"Pure" coke . .	1·0	1·6	9·2	89·2	2·12	0·85	0·009
,,	,, 11/39	Sodium hydrate .	10·8	1·6	13·7	84·7	2·06	0·78	0·008
,,	,, 12/40	Sodium carbonate.	10·3	1·8	13·6	84·6	2·02	0·76	0·009
,,	,, 12/41	"Pure" coke . .	0·9	1·4	7·8	90·8	2·15	0·66	0·009
800° C.	,, 13/42	5 p.ct. coke dust .	1·3	0·9	1·5	97·6	1·92	0·65	0·016
,,	,, 13/43	"Pure" coke . .	1·2	0·9	1·9	97·2	1·93	0·60	0·016
,,	,, 13/44	Calcium oxide. .	9·2	1·4	1·6	97·0	1·76	1·07	0·44
,,	,, 14/45	Sodium carbonate.	13·2	..	4·6‡	95·4	2·40	0·80	0·11
,,	,, 14/46	"Pure" coke . .	1·4	0·9	1·3	97·8	2·01	0·60	0·017
,,	,, 14/47	Sodium hydrate .	12·5	..	4·2‡	95·8	2·36	0·99	0·11

* Heated for 7 minutes in a crucible at approximately 900° C. † *i.e.*—Sulphur evolved as hydrogen sulphide when the coke is treated with 50 p.ct. boiling hydrochloric acid. ‡ Includes moisture.

making further experiments. The retained volatile matter apparently escapes later, at higher temperatures, but, of course, without the same effect on the structure of the now hardened mass. The same cause is indicated by our figures as operating in the production of a compact finely porous coke with sodium carbonate, though there is here some uncertainty for the reason noted above. Sodium hydrate, too, yields similar figures, but the free alkali has evidently destroyed the coking constituents or their effects, since a non-coherent mass, not a coke at all, resulted at both 500° and 800° C.

TABLE 2.—*Crushing Strengths of Coke in Lbs. per Sq. In.*

Description.	500° C. Samples. Average Crushing Strength.	M.*	800° C. Samples. Average Crushing Strength.	M.*
"Pure" coke	534	146	1500	366
Silica	458	165	1270	310
Aluminium oxide . . .	564	168	1270	288
Calcium oxide	670	220	1300	350
Calcium carbonate . . .	551	261	1400	454
Iron oxide	705	143	1970	336
Sodium carbonate . . .	1210	290	2980	320
Coke dust	450	80	1580	240

* Mean divergence from the mean value.

The determined crushing strengths of the cokes showed wide variations, but it was possible to draw the conclusions that the crushing strength had been more than doubled all-round by raising the temperature of carbonization from 500° to 800° C., that the strength had been raised by the addition of oxide of iron in both 500° and 800° C. carbonizations, and very much more raised by the addition of sodium carbonate, again at both temperatures of carbonization. The action of sodium carbonate cannot plainly be attributed to its fusion and consequent cementing action, since at 500° C., while the coke made with it was very hard, the sodium carbonate would be far below its melting-point. Sodium hydrate, as previously noted, gave no coke, but a non-coherent mass.

NATURE AND ORIGIN OF THE MINERAL MATTER IN COAL.

The ash in coal may be divided into two classes: "Inherent" mineral matter, which is fairly uniformly distributed throughout the coal substance, and "adventitious" mixed matter such as slate, shale, or rock-like material occurring in faults or fissures, or arising from contamination in mining. The presence of inorganic constituents in coal may be attributed to:

1. The mineral content of the plants forming the coal.
2. Animal remains.
3. Mechanical contamination of the coal substance with clays, &c., during formation.
4. Infiltrations from geological formations above or below the coal measures.
5. Faults and fissures in the seam.
6. Contamination with the material of the roof or floor of the mine.

Table 3 shows the probable forms in which these ash constituents exist in the coal.

TABLE 3.*—*Inorganic Constituents of Coal.*

Inorganic Constituent.	Forms in Coal.
Silicon	Silicates, sand
Aluminium	Alumina in combination with silica
Iron	Pyrites and marcasite (sulphide)
	Ferrous oxide, ,, carbonate, ,, sulphate, Ferric oxide, ,, sulphate, "Organic" iron, Iron silicates — in small quantities
Calcium	Lime, carbonate, sulphate, silicates
Magnesium	Carbonate, silicates
Sodium and potassium .	Silicates, carbonates, chlorides — in small quantities
Manganese	Carbonate, silicates
Sulphur (inorganic) . .	Pyrites and marcasite
	Ferrous sulphate, Ferric sulphate, Calcium sulphate — in small quantities
Phosphorus	Phosphates

*Compiled mainly from the works of Sinnatt, Lessing, and others.

As regards sulphur, a part occurs in the forms shown above, and the remainder exists in the coal in the form of complex organic compounds.

The nitrogen of coal is present in organic compounds which are held to be derived mainly from the proteins and albuminoids present in the vegetation, and perhaps from animal albuminoid matter.

EXPERIMENTAL.

The influence of the ash constituents during carbonization was examined as follows:

A coal containing less than 1 p.ct. of ash (Yorkshire, New Sharlston Wallsend) was used as a basis. It was crushed in order to pass through a 20-mesh I.M.M. sieve (*i.e.*, allowing a maximum grain size of 1/40 in.) and stored in air-tight tins. Its analysis is shown below:

Proximate Analysis.

	P.Ct.
Loss at 105° C.	2·5
Volatile matter*	34·2
Ash	0·88
Fixed carbon	62·42
	100·00

Ultimate Analysis.

	P.Ct
Loss at 105° C.	2 5
Carbon	82·10
Hydrogen	4·70
Nitrogen	1·85
Total sulphur	0·86
Ash	0·88
Oxygen (by difference)	7·11
	100·00

* Heated for 7 minutes at approximately 900° C.

Analysis of Ash.

	P.Ct.
Silica (SiO_2)	41·4
Iron oxide (Fe_2O_3)	11·3
Aluminium oxide (Al_2O_3)	29·0
Calcium oxide (CaO)	5·5
Magnesium oxide (MgO)	1·8
Sulphuric anhydride (SO_3)	4·4
Not estimated	6·6
	100·0

Mixtures with coal were prepared, each containing 5 p.ct. of one of the following substances:

(1) Silica.
(2) Aluminium oxide.
(3) Iron oxide (Fe_2O_3).
(4) Calcium oxide as (*a*) lime (CaO).
(*b*) carbonate ($CaCO_3$).
(5) Sodium oxide as (*a*) carbonate (Na_2CO_3).
(*b*) hydrate (NaOH).
(6) Coke dust (as a blank or reference).

All the added substances, with the exception of sodium hydrate, were mixed dry with the coal; five parts of oxide, or a quantity of other compound equivalent to five parts of oxide, being added to ninety-five parts of the coal. These additions were first examined for impurities, and were found satisfactory. They were put through a 100-mesh sieve, incorporated with the coal, and the mixtures were carbonized. The method of incorporating sodium hydrate was to add the required amount in the form of a 20 p.ct. aqueous solution, dry in a steam oven, grind, and sieve. These operations were carried out as quickly as possible, to minimize the amount of sodium hydrate converted into carbonate prior to carbonization. Control experiments ensured that the addition of water alone, and subsequent drying, did not appreciably affect the coking properties of the coal. To determine, too, how far any of the effects observed in these experiments were simply due to the addition of a finely powdered "inert" material as such, a control mixture was prepared from coal and 5 p.ct. of coke dust which had been passed through a 100-mesh sieve. This coke dust was prepared from the original coal, carbonized at a temperature of 800° C. Its analysis is given in Table 1 (Sample No. 7/27).

Proximate analyses of the prepared coals were made, and the results are given in Table 4.

APPEARANCE OF THE COKE BUTTONS (PLATE 1).

The buttons obtained in the crucible test with additions of silica, aluminium oxide, calcium oxide, calcium carbonate, and coke-dust resembled those from the original coal; being swollen and of a uniform silver-grey colour. The iron oxide button was dull black, with small beads, and silver grey in parts. It was much smaller and more compact than the button obtained from the original coal; practically no swelling having taken place. The sodium carbonate button was dull black, and contained cracks. It also was very compact, and resembled the iron oxide button in many respects. The sodium hydrate coal formed a dense black mass of little coherence.

TABLE 4.—*Proximate Analyses of Prepared Coals.*
(AIR-DRIED SAMPLE.)

Description.	P.Ct. Loss at 105° C.	* P.Ct. Vol. Matter.	P.Ct. Ash.	P.Ct. Fixed Carbon.	Colour of Ash.
[Original coal	2·5	34·2	0·88	62·42	buff]
Silica†	2·3	33·2	5 8	58·7	white
Alumina	2·2	32·6	6·2	59·0	pale yellow
Calcium oxide	2·1	32·7	6 8	58·4	white
Calcium carbonate	2·0	32·3	7·3	58·4	white
Iron oxide	2·4	32·1	6·3	59·2	dark red
Sodium carbonate	2·5	33·9	9·6	54·0	pale yellow
Sodium hydrate	1·9	32 9	9·2	56 0	pale yellow
Coke dust	2·5	31·6	1 0	64·9	buff

* Determined by the crucible method, being heated for 7 minutes at approximately 900° C.
† *i.e.*, coke + silica.

PREPARATION OF THE COKES.

The cokes were prepared at two temperatures, 500° C. and 800° C. Three fireclay tubes of internal diameter 1⅞ in. and length 12 in. were used as retorts in each heating. One end of the retort was closed by a cast-iron cap which was luted-in with fireclay. The other end was closed by a loose-fitting cap which allowed the gases to escape. The three retorts were filled with the charge (about 300 grammes), "tapped down" in order to leave about 2 in. free space, and then placed side by side in a Fletcher gas-fired furnace, with two muffles, one above the other. A small hole was drilled in the cap of the middle retort to allow a thermocouple to be placed in the centre of the charge. The 500° C. cokes were prepared in the upper, and the 800° C. cokes in the lower, muffle furnace. The mouths of the furnaces were fitted with heavy firebrick doors, and luted-in with fireclay. Trials were made to test the distribution of temperature; and when the retorts were filled with sand, the range of temperature was not greater than 50° C. For a second series of carbonizations (samples 10/34 to 14/47) "non-porous" fireclay retorts, which had become available, were used.

PERIOD OF CARBONIZATION.

500° C. Cokes.—The burners of the furnace were adjusted in such a manner that two hours was the time taken in raising the charge to a temperature of 500° C. The charge was maintained at this temperature for three hours—*i.e.*, five hours total heating—the furnace allowed to cool, and the coke withdrawn when cold.

800° C. Cokes.—In the majority of experiments the time taken to heat up the charge to a temperature of 800° C. was three hours, but some cokes were prepared in which the heating-up period only occupied two hours. In all cases the temperature of 800° C. was then maintained for three hours, the furnace allowed to cool, and the cokes withdrawn when cold.

Though the attempt was made to ensure the same conditions in every carbonization, it was considered advisable to carbonize always, as a reference, a sample of the original coal; and subsequent analyses of the cokes justified the precaution.

The results of the carbonization may now be considered.

Appearance of the Cokes Prepared at 500° C.

All cokes prepared from original coal	These cokes were all very similar in appearance, being swollen, spongy, and not homogeneous.
5 p.ct. silica	
5 p.ct. aluminium oxide	
5 p.ct. calcium oxide	
" " " added as carbonate.	
5 p.ct. coke dust	

5 P.Ct. Iron Oxide Coke.—This coke was much more compact and more finely porous than those described above; it was darker in colour and quite homogeneous. A quantity of dust found in the retort, especially near the outer end, was probably due to oxidation, and so far confirms statements previously made as to the increased "combustibility" of a coke containing added iron compounds. [2,3]

5 P.Ct. Sodium Oxide added as Sodium Carbonate.—The resulting coke was dense, closed grained, and hard, with some lustre. There were no visible large pores, and the whole of the coke column was homogeneous. The outer end of the column showed patches of vivid blue colouring matter. This coke resembled the iron oxide coke in many respects, but was stronger.

5 P.Ct. Sodium Oxide added as Sodium Hydrate.—The material formed was not a true coke. It was re-

moved from the retort as a slightly-coherent mass, was dull black in appearance, and readily crumbled to a fine powder.

Appearance of the Cokes Prepared at 800° C.

All cokes from original coal 5 p.c. silica 5 p.c. aluminium oxide 5 p.c. calcium oxide " " " added as carbonate 5 p.c. coke dust	These were closer grained in structure than the 500° C. cokes, but still spongy, with many large pores and much unsound material—not homogeneous.

5 *P.Ct. Iron Oxide Cokes.*—These cokes were hard, compact, and homogeneous, not containing any large pores. Dust had formed in some quantity, and the outside end of the coke column was very soft. The cokes were similar in appearance to those prepared at 500° C. All the iron oxide cokes were examined for the presence of metallic iron; and, from the results obtained, it is extremely improbable that metallic iron existed in the cokes prepared at 500° C., but the 800° C. cokes did give unmistakable evidence of the presence of the metal. (See Appendix 1.) Opinions differ as to the presence of metallic iron in prepared cokes. Parr[4] states that at a temperature of approximately 700° C. the sulphur of ferrous sulphide is taken up by the carbon, leaving free iron in the coke; but Powell[5] could not detect metallic iron in the " finished " cokes. Williams and collaborators[6] state that when iron oxide is heated with coal, practically no reduction of the oxide occurs below a temperature of 880° C., but above this temperature the action proceeds rapidly.

5 *P.Ct. Sodium Oxide added as Sodium Carbonate.*—This coke had shrunk very much more than any of those previously described, and there was very little dust in the retort. Where cracks had ocurred, the coke had a golden-brown appearance, and both ends of the column were dark blue in colour. It was fine grained, homogeneous, and quite free from large pores, resembling the sodium carbonate coke prepared at 500° C.

5 *P.Ct. Sodium Oxide added as Sodium Hydrate.*—No coke was formed at this temperature, and the resulting material was very similar to that obtained at 500° C. It was a little harder, but was still very readily powdered. A blue colouration was noticeable at both ends of the coked mass.

Preparation of Samples for Analysis.

Several pieces of coke were taken from various parts of the retort, and their ash was determined. This was done in order to ascertain whether the added constituent was evenly distributed throughout the mass. Usually the ash content did not vary by more than 0·5 p.ct. Cubes were cut out from the coke, and reserved for the determination of the crushing strength. The rest was powdered for analysis; material near the retort wall being rejected. The methods of analysis are shown in Appendix 1, while the results, corrected to an ash-free basis, are given in Table 1.

Determination of the Crushing Strength of the Prepared Cokes.

From six to ten $\frac{1}{2}$-in. cubes were cut from each coke by means of a hack-saw, and trued-up on an emery wheel, fitted with a surface grinding table. The crushing strength was determined on a Denison testing machine. Considerable difficulty was sometimes experienced in the preparation of these cubes, owing to the irregular nature of the coke mass. The results are given in Table 2.

These results were irregular, but the determination served to show the higher crushing strengths of the iron oxide and sodium carbonate cokes and of the 800° C. cokes as compared with the 500° C. cokes. The wide discrepancies obtained with test pieces from the same sample of coke may be attributed to inherent difficulties in the determination of the crushing strength of a material like coke, arising from its lack of homogeneity, the existence of cracks and fissures, and the variation in its mode of collapse, coupled with the effects of such small-scale working.

Specific Gravities of the Cokes.

The true specific gravities of the " pure " and iron oxide cokes, prepared at 800° C., were determined, and gave values of 1·83 and 1·90 respectively. Assuming that the added iron oxide has remained unchanged, and that the volume of the prepared coke is that of the " pure " coke *plus* that of the added oxide, the calculated specific gravity of the iron oxide coke would be 1·91. Therefore no change in the specific gravity of the iron oxide coke material is indicated. Proceeding similarly, the sodium carbonate coke gave a specific gravity of 1·96, and a slight increase in the specific gravity of the coke material was indicated, but in this case the figures obtained are less reliable.

Analytical Results.

Volatile Matter Content of the Prepared Coals.—Table 5 shows the results of the ordinary proximate analysis applied to the mixtures before carbonization.

TABLE 5.—*Proximate Analyses of Prepared Coals.*

Description of Coal.	P.Ct. Ash.	Calculated on Ash-Free Basis.		
		P.Ct. Loss at 105° C.	P.Ct. Vol. Matter.	P.Ct. Fixed Carbon.
[Original coal	0·88	2·5	34·5	63·0]
Silica	5·8	2·4	35·2	62·4
Aluminium oxide	6·2	2·4	34·8	62·8
Calcium oxide	6·8	2·3	35·1	62·6
Calcium carbonate	7·3	2·2	34·8	63·0
Iron oxide	6·3	2·6	34·3	63·1
Sodium carbonate	9·6	2·8	37·5	59·7
Sodium hydrate	9·2	2·1	36·2	61·7
Coke dust (*a*)	1·0	2·7	34·3	63·0
Coke dust (*b*)	1·0	2·5	31·9	65·6

(*a*).—Result given under coke dust (*a*) is the one valid for the purposes of this comparison. It is made by reckoning coke as ash in the calculation.

(*b*).—Calculated on a true ash-free basis.

Sinnatt and Grounds[7] found that increasing additions of " inert " material gave increases in the volatile matter, but Webster and Wigginton[8] state that the addition of " inert " matter, such as silica, had no effect on the amount of volatile matter evolved. Kreulen[9] mixed coal with a proportion of its own ash, and found that the amount of volatile matter increased, and that the addition of different " inert " materials gave varying results. Lessing and Banks[1] obtained the following results (Table 6) by adding approximately 1 p.ct. of the reagent named to a prepared coal. It should be noted, however, that the conditions under which Lessing and Banks carried out their experiments varied somewhat from those adopted by us, and that a correction for the added ingredient has been applied by them.

TABLE 6.—*Influence of Catalysts on the Carbonization of Coal at 900° C. (Lessing and Banks).*

Coal.	Coke (*less* Compound Formed).	Retort Carbon.	Volatile Matter.*
Original coal	53·68	8·48	37·84
Silica	63·34	1·51	35·15
Alumina	62·92	1·95	35·13
Iron oxide	62·23	3·34	34·43
Lime	61·08	3·42	35·50
Sodium carbonate	63·50	1·74	34·76

* Calculated from the results obtained by Lessing and Banks, taking volatile matter = 100 − (coke + retort carbon).

There is, therefore, no agreement as to the influence of the added ash constituents on the amount of the volatile matter as ordinarily determined. Our own results do not clearly indicate any appreciable effects. The high results with sodium carbonate and hydrate may be due to carbon dioxide.

Analyses of the Prepared Cokes.

The following notes may be made on the results obtained by analyzing the prepared cokes, and reported in Table 1.

When the cokes were prepared in porous fireclay retorts, the results in general were somewhat different from those obtained when non-porous fireclay retorts were used. Presumably, when using non-porous retorts, some of the gas which otherwise escaped directly through the walls would have to travel along the mass of hot coke, and this would affect the quantity and quality of the products of carbonization. In the later stages of carbonization, diffusion and consequent oxidation would be minimized by the non-porous retort; and of this, too, there was evidence.

Ash.—The calcium carbonate and calcium oxide cokes

had a greater ash content than the calculated calcium oxide. Part of the sulphur in these cokes was present as sulphide, and under the conditions of the ash determination would be partially converted into sulphate, thus giving a higher ash content.

Loss at 105° C.—The smaller amounts of moisture present in cokes Nos. 10/34 to 14/47 inclusive are attributed to the fact that the operations of sampling, grinding, and sieving were carried out very expeditiously with those samples. It was impossible to determine the moisture content of the 800° C. sodium carbonate and hydrate cokes by the ordinary method. When heated for one hour at 105° C. irregular results were obtained; in some cases an increase in weight being recorded.

Volatile Matter.—The cokes prepared in the first series of experiments showed some evolution of incandescent carbon particles during the determination of volatile matter; and this was most marked in the case of the iron oxide coke. With cokes prepared in the second series, no such evolution of carbon particles was observed. This difference may be attributed to the higher moisture content of the earlier cokes.

Nitrogen.—It does not follow that, because the nitrogen left in the coke was lowered by an addition, the ammonia in the gas was raised. Decomposition of the ammonia may have occurred. This remains for investigation.

Sulphur.—It is known that the admixture of calcium oxide tends to retain the sulphur, and it is usually stated that calcium carbonate fulfils the same function; but according to our experiments calcium carbonate had no apparent effect on the sulphur content of the coke. When increased reactivity in such uses as iron smelting is claimed for cokes as a result of the addition of iron oxide, the accompanying effect in raising sulphur should not be overlooked. The determination of "sulphide" sulphur was carried out in order to examine in particular those cokes in which the total sulphur content was greater than that of the "pure" coke. No "sulphide" sulphur was found to exist in the original coal; and other workers, notably Powell,[10] have arrived at the same conclusion. Though the 800° C. iron oxide cokes showed a large increase in their total sulphur content, yet this could not apparently be accounted for by a corresponding increase in the amount of "sulphide" sulphur. An explanation may be found in the researches of Powell.[11] He states that the sulphur in hot coke is present as (1) sulphur in solid solution with carbon, and (2) ferrous sulphide together with small quantities of calcium and magnesium sulphides. When coke is cooled, even with limited access of air, oxidation of ferrous sulphide occurs:

$$4FeS + 3O_2 = 2Fe_2O_3 + 4S.$$

Sulphate is also formed, but in smaller quantities. Calcium and magnesium sulphides do not readily decompose during the slow cooling, and are consequently found as "sulphide" sulphur in the coke. When, however, coke is quenched, the decomposition of the ferrous sulphide is not completed, due to the speed at which the temperature of the coke is carried below that for effective oxidation. As a result, in a quenched coke there is more "sulphide" sulphur present, and less elemental sulphur, than in one slowly cooled. All the cokes made by us were allowed to cool in the retort; the process occupying some hours. When the sulphide content of the iron oxide coke was being determined, traces of a yellow substance having the appearance of sulphur were observed in the delivery tube; and this pointed to the presence of elemental sulphur in the coke, or sulphur combined in such form that it is readily liberated as elemental sulphur. This is all in accord with Powell's observations; and his explanation would account for the low "sulphide" sulphur content of the iron oxide cokes, and the high value in the lime coke. Another point worthy of note is that the iron oxide coke prepared at 800° C., with three hours heating-up, contained more than ten times as much "sulphide" sulphur as that prepared at the same temperature, but taking two hours to heat up. This difference may be due to the longer time of heating or to a different rate of cooling, but remains puzzling in its magnitude. According to Powell, the dissociation pressure of sodium sulphide is much lower than that of ferrous sulphide. Hence the presence of sodium sulphide in the sodium carbonate and sodium hydrate cokes is very probable, and would account for the amounts of "sulphide" sulphur obtained therein. The amount retained as sulphide, however, is only a quarter of that retained by the calcium oxide coke.

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HISTORICAL REVIEW.

By C. B. MARSON.

Lessing has repeatedly pointed out the possible catalytic influence of the ash content. In 1914[1] he indicated the importance of the ash and its effects on primary and secondary products of carbonization. In 1920[2] he stated that differences in the behaviour of clarain, durain, fusain, and vitrain, when carbonized, might be attributed to the catalytic influence of their ash constituents, whose compositions varied considerably. In some later work[3] Lessing and Banks examined the influence of various catalysts on the carbonization of coal. In their first series of experiments, samples of cellulose and sucrose were treated with about 1 p.ct. of each reagent. The coke yield was estimated by heating the prepared mixtures for three minutes, in a platinum crucible under standard conditions, and was found to vary appreciably.

Carbonization experiments were also conducted on a specially-prepared coal consisting chiefly of clarain and vitrain. This was carbonized in an electric coking furnace, and the resulting coke, tar, and gas were determined. Here again the yield of coke was considerably influenced by the type of compound added; the greatest yield being obtained from the coal treated with ferric chloride, and the least yield from the untreated coal.

Sinnatt and collaborators have investigated the inorganic constituents of coal. In 1920[4] they made a study of the ash content, examining in detail the composition of the white partings known as ankerites; and they also came to the conclusion that much of the iron content of coal exists in the ferrous state. In 1922, Sinnatt and Simpkin[5] examined the forms in which iron exists in coal; and in the same year[6] they published the results they obtained from an exhaustive study of the chemical composition and behaviour of pyrites as found in coal.

FORMS OF SULPHUR IN COAL AND COKE.

In 1921, Yancey and Fraser[7] showed that in low-sulphur coals the percentage of organic sulphur is greater than in high-sulphur coals. Wibaut[8] states that above 500° C., under the conditions of carbonization, the pyrites present in coal decompose and combine with the carbon to form a sulphide of carbon which is non-volatile up to a temperature of 1000° C.; and he confirmed the formation of carbon sulphides by synthetic experiments. When coal is carbonized, the organic sulphur content increases, while the mineral sulphur content decreases. Foerster and Geisler[9] also found that the greatest proportion of the sulphur in coke is present in the organic form; only small quantities being present as pyrites, sulphate, and ferrous sulphide. When examining a lignite containing appreciable

quantities of lime, most of the sulphur was retained as calcium sulphide.

Powell has investigated the forms of sulphur present in coal and coke in very great detail. He states that the sulphur in coal[10] exists as (*a*) organic compounds, (*b*) pyrites, (*c*) sulphates, and that the sulphur exists in coke[11] as (*a*) a "solid solution" of sulphur in carbon, (*b*) iron sulphide together with traces of other inorganic sulphides, (*c*) sulphates, and (*d*) adsorbed free sulphur. The relative proportions of these four forms, however, are likely to be affected by the conditions of cooling.

Donath[12] examined the ash from a large number of coals, and found that it contained appreciable quantities of iron monosulphide. He states that this promotes caking and tends to make the ash viscous.

Mineral Constituents of Coke.

Opinions differ as to the forms in which the mineral constituents are found. Heyd[13] maintains that silicon, iron, and aluminium occur in coke as complex organic and inorganic compounds such as carbides and silicides, and that the "combustibility" of coke largely depends on the nature of the ash. Schreiber,[14] however, states that the iron, silicon, and aluminium are present as oxides in the coke, and does not agree with Heyd as to the preponderating influence of the ash content on the "combustibility" of coke.

The Addition of Inorganic Compounds to Coal.

Numerous patents have been taken out, claiming increased efficiency in gas and coke manufacture by the addition of various inorganic compounds to the charge. Calcium oxide and calcium carbonate have been employed most, though of recent years the use of iron compounds has been recommended. As early as 1882 Cooper[15] patented a process whereby lime or chalk was added to the charge, the object being to increase the production of "ammonia or ammoniacal compounds or of tars or gas." The so-called "liming" of coal has, however, been a subject of great controversy. Schreiber[16] stated that Cooper's old process of "liming" was not successful unless small coal was used and intimately mixed with the lime. When using lime in this way he obtained more ammonium sulphate, less sulphur in the gas, and greater quantities of sulphur in the coke. The Paterson-Twycross process[17] consists in adding lime to coal, with the object of increasing the yield of gas and ammonia, and decreasing the amount of impurities in the foul gas. In this process intimate mixture of the lime and coal is obtained by using a special machine to add the lime evenly to the coal, and then moistening the layer with steam, in order to enclose the particles of coal in a case of lime. In the Diehl-Faber[18] process the lime is added in the form of carbonate; and it is claimed that a better coke is obtained, while at the same time the ammonia content of the gas is increased. Only one-third of the sulphur is fixed in the coke. Stevenson[19] used calcium carbonate at Long Eaton, claiming increased yields of toluole and benzole in the resulting gas. Serious objections have been made to these processes.[19] It has been stated that the lime has a deleterious effect on the coke, rendering it useless for domestic purposes. When the coke was used in producers, clinkering and firebar difficulties were experienced. Furthermore, it required heavy charges and long periods of carbonization. The calcium carbonate or oxide must be pure, and intimately mixed with the coal.

The addition of iron oxide to coal has been recommended; the chief object being the increased "combustibility" and "reactivity" of the resulting coke. A patent[20] has been taken out whereby metallic iron, iron oxide, or carbonate is intimately mixed with the coal to give 1 to 3 p.ct., or its equivalent, of metal in the coke. The charge is then carbonized, preferably above a temperature of 900° C. It is claimed that the resulting coke has an increased efficiency in gas and water-gas producers, and when used in blast furnaces. Arend and Wagner[21] also claim to increase the porosity and "reactivity" of metallurgical coke by the addition of iron oxide to coal prior to carbonization. Campbell[22] has pointed out that the catalytic effect of iron and its oxides favours the dissociation of ammonia. Low ammonia yields have been traced to an increase of the iron content in the ash of the coal used.

Powell[23] carried out some experiments in which coke, lime, and spongy iron were heated together; and he found that no sulphur was absorbed by the iron, all of it being taken up by the lime. Magnesium oxide and sodium carbonate acted similarly to the lime. Under blast-furnace conditions, in the zone of spongy iron, a considerable amount of sulphur is absorbed by the iron from the coke; and it is the ferrous sulphide constituent of the coke which gives-up sulphur at this point. Iron does not readily combine with the sulphur of calcium sulphide. Powell, therefore, recommends the decomposition of ferrous sulphide in the coke by some desulphurization process, or by "liming" the coke.

Numerous investigators have recommended the addition of coke or coke breeze to coal prior to carbonization. Among others may be quoted E. V. Evans[24], who states that the addition of 25 p.ct. of coke to coal prevents the formation of the plastic layer, and consequently better heat transmission throughout the coal substance is obtained. When 25 p.ct. of coke dust was mixed with coal and briquetted, Evans found that the rate of gas evolution was increased, the time of carbonization decreased, a greater thermal yield per ton obtained, and the resulting coke was more dense and combustible than coke prepared from pure coal.

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APPENDIX 1.

Methods of Analysis.

Material passing through a 60-mesh sieve was used for proximate analyses, and 100-mesh material for the determinations of nitrogen, and total and sulphide sulphur. All analytical determinations were carried out in duplicate.

Loss at 105° C.—One gramme was dried in a hot-air oven, for one hour, at a temperature of 105° C.

Volatile Matter.—This was determined by a modification of the platinum crucible method, as described by Hodsman.*

Ash.—One gramme of the coal was ignited in a silica crucible and weighed until constant. It was found necessary to ignite calcium oxide, calcium carbonate, sodium hydrate, and sodium carbonate cokes in (1) an electric muffle furnace, or (2) a gas-fired muffle furnace in which the lining was in good condition; otherwise sulphur from the products of combustion was absorbed by the ash. The sodium carbonate and hydrate cokes were burnt-off very slowly (in porcelain crucibles), to prevent fusing or fritting of the ash and consequent entanglement of carbon particles.

Total Sulphur.—This was estimated by fusion with sodium peroxide, as recommended by Hodsman.†

Sulphide Sulphur.—The method adopted was a modification of that used to determine the sulphur content of steel and wrought iron. A quantity of 1 to 5 grammes of the sample, depending on the quantity of sulphide sulphur present, was placed in a 350 c.c. conical flask fitted with two tubes and a dropping funnel. One tube communicated with a cylinder of hydrogen, and the other tube dipped into a vessel containing 100 c.c. of cadmium acetate solution. This delivery tube was so inclined that any

* Journ. Soc. Chem. Ind. (1922), **41**, pp. 372T-373T.
† Journ. Soc. Chem. Ind. (1921), **40**, p. 74T.

hydrochloric acid which condensed out returned to the flask. Hydrogen was passed through the apparatus for five minutes, then 100 c.c. of hot 50 p.ct. hydrochloric acid were added through the dropping funnel, and the contents of the flask boiled gently for 25 minutes, after which they were vigorously boiled for a further five minutes. The cadmium sulphide was filtered-off, washed, and its amount determined by titration with $\frac{N}{10}$ iodine solution in the usual manner.

Detection of Metallic Iron in Coke.—The following method was devised: Five grammes of the 100-mesh sample were treated with boiling water in order to remove any soluble iron compounds. The coke was washed and then placed in 50 c.c. of 20 p.ct. copper sulphate solution. After allowing to stand for a short time, the mixture was filtered, and a few c.c. of concentrated nitric acid added to the filtrate, which was then boiled. The solution was made alkaline with ammonia; and any resulting precipitate of ferric hydrate indicated the presence of metallic iron in the coke. (Confirmed by the potassium sulphocyanide test.)

$$\underset{\text{(metallic)}}{Fe} + CuSO_4 = \underset{\text{(metallic)}}{Cu} + FeSO_4$$

This method appeared to us to be more certain in its operation than the one described by Powell, in which the microscopic detection of metallic copper in the coke, after treatment with copper sulphate, is relied upon to indicate the presence of metallic iron.

True Specific Gravity of Coke Material.—This was determined, on samples ground to pass through a 200-I.M.M. sieve, by the method described by Greenwood and Cobb.‡

APPENDIX 2.

The Determination of Ash, Using Silica Crucibles.

In the course of this work several hundred ash determinations were made, and it was noticed that the weight of the silica crucibles used usually decreased:

Original weight .	(R) 17·4695 ..	(S) 13·6480 ..	(T) 18·9705 grammes.
Final weight . .	17·3520 ..	13 4585 ..	18 8350 ,,
Loss . . .	0·1175 ..	0 1895 ..	0·1355 ,,

The ash constituents combine with the material of the crucible; and when the latter is cleaned a small amount of silicate is removed. With ashes containing high percentages of iron oxide, however, a small amount of chemical combination takes place, and after the crucible is cleaned, an increase in weight is recorded. The weight of the crucible remains constant until the glaze is removed from the inside surface.

Hygroscopic Nature of Coke.

This was demonstrated in a very marked manner. In many cases the moisture content of the prepared cokes was as high as 4 p.ct. This amount of water must have been absorbed by the cokes during cooling and the subsequent sampling, grinding, and sieving. In later experiments (samples No. 10/34 to 14/47) the preparation of the samples for analysis was completed as expeditiously as possible; and it will be seen that under these conditions the moisture content does not amount to more than 2 p.ct. This hygroscopic property of the cokes was in no way confined to cokes made with special oxide additions. This property of coke points to the necessity for using the same graded sample for the moisture and volatile matter determinations. Furthermore, these operations should be carried out at the same time.

Addition of Various Amounts of Iron Oxide to Coal.

The remarkable influence exerted by the 5 p.ct. admixture of Fe_2O_3 on the coking properties of the coal suggested the advisability of trying at once what would be the effect of smaller additions. With this in view, mixtures of coal containing 1, 2, 3, 4, and 5 p.ct. of iron oxide were prepared and carbonized in porcelain crucibles at a temperature of approximately 800° C. The 1 p.ct. iron oxide coke was porous and spongy but less so than the "pure" coke. The 2 p.ct. coke showed a marked decrease in the number of large pores, being hard and compact; and these characteristics became most marked in the case of the 3 p.ct. iron oxide coke. The cokes containing 4 and 5 p.ct. of iron oxide were compact in structure, finely porous, but not very resistant to rubbing, being very similar to the 5 p.ct. iron oxide cokes previously prepared on a somewhat larger scale in retorts, as described in the preceding text.

‡ "Journ. Soc. Chem. Ind." (1922), **41**, pp. 181T-183T.

Prof. Cobb, in introducing the Gas Research Fellowship Report, said: For some years past the Gas Research Fellow has been occupied with the study of various phenomena in the gasification of coke, dealing with the liberation of nitrogen and sulphur in different gaseous atmospheres, the rates of gasification of coke in steam, and the quality of the gas produced. In turn, Dr. Monkhouse and Dr. Pexton have worked on this theme. It has been indicated more than once that, to an unknown extent, the results are probably influenced by the quantity and quality of the ash present in the coke; and during the past twelve months Mr. Marson has made a start in studying this influence of ash. There are so many kinds of ash in coke, and the quantity varies so much, that it would have been useless, at any rate for a beginning, to attempt to draw any conclusions from the direct comparison of a number of ordinary cokes.

The ideal plan would have been to take a coal without ash, and add to it ash constituents in turn, noting their effects. Another plan would have been to follow the example of Dr. Lessing (who has quite rightly insisted upon the importance of this subject for many years, and worked upon it) in starting with a pure substance like sugar or cellulose. Neither of these methods was available for us, because there is no such thing as an ashless coal, and because we wished to concern ourselves with nitrogen and sulphur, and they existed in coal, and did not exist in substances like pure cellulose. What we actually did was to take a carefully chosen sample of New Sharlston coal containing only 1 p.ct. of ash, and add to it 5 p.ct. of each of the commonest ash constituents in turn, so obtaining mixtures in which a particular ash constituent was always present in dominating quantity.

The work naturally divided itself into two parts, the first being the preparation of the special cokes and their preliminary examination. This represents the stage which has been attained and is reported. It will be followed by more extended study of the behaviour of the cokes so prepared in gasification.

Some interesting results were secured; and it became plain, as has already been pointed out by Dr. Lessing, that both the process of carbonization and the structure of the resulting coke may be materially influenced by the ash constituent. This is obviously very important, partly because ash is one of the things that we have always with us, and in quantities that are by no means negligible, so that any effects due to ash should be studied and known, and partly because, if it is found to be worth while, the addition of a particular ash constituent could be made, especially where grinding, blending, or briquetting processes were contemplated.

I will only give the briefest summary of the results. The addition of oxide of iron or of sodium carbonate effected a great change in the character of the coke produced, rendering it stronger and finely porous, instead of swollen and honeycombed. This is indicated clearly by the photograph reproduced in the text, and the samples which are exhibited. It is possible to speculate as to the reason for this effect. Volatile matter left in the coke prepared at 500° C. is considerably higher in a coke made up with oxide of iron than in the pure coke. This probably means that less volatile matter is expelled at the time when the coke is in the plastic state, when it can be puffed up by escaping gas, and its structure determined. This would account for the more finely porous structure of the oxide of iron coke; but the phenomenon requires more extended examination.

Prof. Cobb then read one or two passages from the summary of the report, saying that Mr. Marson, who had carried out the whole of the experimental work, would follow.

Mr. Marson said: I thank you for your invitation to attend your annual meeting, in order to give an account of the work which Prof. Cobb and I have carried out during the past year. During the last four years the work in connection with the Gas Research Fellowship has consisted of a detailed examination of the carbonization and gasification of coal and coke, special attention being paid to the liberation of N_2 and S, rates of gasification, and composition of gas produced. We have continued this investigation during the past year; but our special object has been to attempt to trace any phenomena which could be directly attributed to the influence of the inorganic ash constituents of coal.

The method we adopted was to make 5 p.ct., or the equivalent of 5 p.ct., additions of various substances to a coal containing less than 1 p.ct. of ash, carbonize the various mixtures, and examine the cokes produced. The coal was crushed, passed through a 20-mesh I.M.M. sieve, and mixtures were prepared, each containing 5 p.ct. of one of the following substances: Silica, alumina, ferric oxide, calcium oxide as (*a*) lime, (*b*) carbonate, and sodium oxide as (*a*) carbonate, (*b*) hydrate. We also made up a mixture containing 5 p.ct. of coke dust, to ensure that none of the effects observed was simply due to the addition of a finely-powdered material.

Proximate analyses of the prepared coals were made. The amount of volatile matter, as determined by the standard laboratory method, gave no very marked indication of its being influenced by the incorporation of the various reagents. The appearance of some of the coke buttons obtained in this test, however, did differ from those obtained from the untreated coal; the latter being swollen and uniformly silver grey in appearance. The iron oxide and sodium carbonate buttons were dull black in appearance, dense and compact, very little swelling having taken place; while the sodium hydrate prevented the formation of a button, only a dense black mass of little coherence being obtained. The additions of silica, alumina, lime, calcium carbonate, and coke dust had no effect on the appearance of the coke button obtained, when compared with that from the untreated coal. The appearance of these coke buttons did indicate the kind of coke we obtained when we carbonized the prepared coals on a larger scale.

The prepared coals were carbonized in a gas-fired muffle furnace, using three fireclay retorts each of which held approximately 300 grammes. Three cokes were made simultaneously in each carbonization, and one of the three cokes was made from the coal without addition of any substance, so that we could use this coke as a reference or blank. Each coke was prepared at two temperatures, 500° and 800° C.; the period of carbonization taking from 5 to 6 hours. The cokes were then examined for crushing strength, proximate analysis, nitrogen, total sulphur, and "sulphide" sulphur (*i.e.*, sulphur evolved as sulphuretted hydrogen when the coke was treated with HCl).

The additions of iron oxide, sodium carbonate, and sodium hydrate caused marked changes in the physical character of the resulting cokes. The cokes prepared from the untreated coal were porous and spongy, whereas those prepared with iron oxide and sodium carbonate were dense and hard, being much more resistant to crushing. The addition of sodium hydrate completely destroyed the coking property of the coal. Additions of other compounds had no apparent effect on the physical structure or crushing strength. The crushing strength of all the cokes made was more than doubled by carbonizing at 800° C. instead of 500° C., while it was very much increased at both temperatures by Fe_2O_3 and Na_2CO_3 (especially the latter). The determination of the amount of volatile matter in the prepared cokes (by the standard laboratory method) showed that the iron-oxide coke prepared at 500° C. had retained some of the volatile matter, normally expelled at that temperature; but at 800° C. this difference was eliminated. Conclusions from the volatile matter determinations of the remaining cokes cannot be drawn, owing to the differences not being sufficiently marked, and to the presence of carbonate in some of the cokes.

No changes in the nitrogen content of the cokes prepared at 500° C. were observed, but at 800° C. it was found that the additions of Fe_2O_3, CaO, and $CaCO_3$ had decreased the amount of N_2 retained by the coke, while sodium hydrate and carbonate had increased it. The other oxide additions were without effect.

Iron oxide and lime retained the sulphur held by the 500° C. coke, and to a greater extent in the 800° C. NaOH and Na_2CO_3 tended to retain the S in the 800° C. cokes; but this effect was not evident in the 500° C. cokes.

Sulphide sulphur (essentially a product of carbonization) is produced at 500° by lime and at 800° C. by NaOH, sodium carbonate, calcium carbonate, iron oxide, and lime; its amount being the greatest in the case of lime. The remaining cokes, including that prepared from the untreated coal, only contained traces. The amount of sulphide sulphur found in the coke is largely dependent on the stability of the inorganic sulphide and on the conditions of cooling.

Samples of the special cokes are here for examination.

We shall be pleased to answer any questions or written communication in connection with this report.

Dr. R. LESSING: I should like to congratulate Prof. Cobb and Mr. Marson on what I consider an extremely important piece of work. I feel personally very gratified at seeing that others are now taking up this particular line of investigation in which I have been interested for many years. It is about 14 years since I made my first venture at it; and I am afraid that so far I have been a prophet in the wilderness. This work before you to-day however, certainly has an enormous influence on carbonization; and I am glad to have Prof. Cobb's confirmation of my contention. I will not go into the details of the results, though I may say, in general, that they confirm my own observations even as regards details—for instance, the addition of iron compounds, and sodium compounds, and their relation to the physical and chemical properties of the cokes obtained. I consider the influence of the ash components on the carbonizing process—I do not feel any hesitation in using the word—immense. The conclusion in the paper which Mr. Banks and I read before the Chemical Society last year actually put the claim forward that all our scientific work on carbonization that has been done in the past will have to be reconsidered in the light of the composition of the coals used as regards their inorganic constituents. It may be that in many cases the influence will be slight, but I do believe that the carbonizing process is influenced to a very much greater extent than I ever dreamed of, even a few years ago, and, of course, that will lead to very great developments in other directions. One point I may perhaps refer to in detail is that on the whole, from the work that I have in hand, I do believe that in the first instance great improvements can be hoped for from a reduction in the ash content. I prefer to call them the mineral constituents of the coal, though the specific composition of the ash is of importance; but it appears that in a general way the volatile therms are increased if the ash is lower. On the whole I think the actual gas yield is not influenced to any great extent. The amount of tar produced from coal, however, is influenced to a very remarkable extent; and from that point of view—*i.e.*, the production of the maximum yield of bye-products, and at the same time a suitable coke, and particularly the maximum yield of liquid therms—these questions have to be considered in very much more detail than we have done before. There is one method of investigation with regard to coke production which so far has not received sufficient attention. To-day we are very much concerned with the structure of coke; and the method I refer to is that proposed a little while ago by Mr. Sinnatt, the Deputy Director of the Fuel Research Station, for coking coal in individual particles, whereby he obtained hollow spheres which he called cenospheres, by allowing the coal to drop through a heated tube, and then coking the coal practically independently of its mechanical mixture with its neighbouring particles. If this method were developed, paying due regard to the inorganic constituents, we should learn a great deal. There are one or two small questions on technical points which I should like to mention to get them on record. I should like to suggest that possibly in the final form of this report some details might be given of the actual coke yield obtained from the various coal mixtures. I have not been able, in the short time the report has been available, to see if these figures are given; and it would certainly be useful to have the actual coke yields. This would allow Table 1 to be re-calculated for a uniform quantity of original coal. As regards crushing strengths, my results, as I have said, confirmed those in the paper—for instance, the increased crushing strength of coke by the addition of iron, and particularly of sodium carbonate. At the same time, I think a note of warning should be sounded that crushing strengths determined on small pieces from small total bulks of coke—as they can only be obtained in tubes—must be treated with great caution, as is actually pointed out in the report, in which attention is directed to the enormous error in a series of experiments. I would invite further work on this subject, on which I am absolutely certain will depend a very great deal in the improvement, not only of coke itself, but also of the whole carbonizing process. I believe the time will come, and very shortly too, when we shall be able to carbonize coals with very much lower ash contents than we do to-day, going down perhaps to 2 p.ct. of ash. The sample of coal used in this report was a selected one; but I am speaking of commercial fuels, and of coal not having more than 2 p.ct. of ash, and possibly even of ash of a definitely selected composition.

The PRESIDENT: I am certain Prof. Cobb and Mr. Marson will be very pleased to receive any communications from any member of the Institution with regard to this report.

Prof. COBB: I thank you for the manner in which you have received this report.

Mr. MARSON: I also should like to thank you, and especially Dr. Lessing, for the kind things said of the report. I do not think there are any questions I have to answer; but with regard to the coke yield, we have not taken measurements to obtain that. This is a thing, however, which we may be able to do at a later stage, because, when we commence our experiments on the gasifying of these cokes which we have made, we shall have to make more coke, and probably we shall then be able to obtain the coke yields.

The PRESIDENT: There was to have been a meeting of the Gas Investigation Committee recently to consider the programme during the ensuing twelve months; but I understand there is to be a meeting to-morrow morning. This subject is a very important one; and I hope the Gas Investigation Committee will follow this up, because the question of sulphur in gas is one which we must tackle.

Gas Appliances in Illinois University.

Affiliated associations, and even individual gas companies, might, says the "American Gas Association Monthly," profitably consider following, in their geographical sections, the lead of the Illinois Gas Association, who recently donated a series of industrial and other gas appliances for the instruction and use of students in the University of Illinois. The Illinois Power and Light Corporation donated the mains, services, &c., and the University installed at their own expense the boosters, electric motors, switches, and similar auxiliary equipment necessary. The total expenditure amounted to approximately $10,000. Most of the equipment is being used in the ceramics department, the chemistry department, the forge shop, the steel treating shop, and the foundry. The Illinois Gas Association are co-operating with the University of Illinois in their gas activities in a number of ways. Among other things, they are trying to obtain a class of not less than twenty students who will devote their last two years to the study of gas engineering.

ALKALI WORKS CHIEF INSPECTOR'S REPORT.

In his report to the Minister of Health on the proceedings during the year 1924 under the Alkali, &c., Works Regulation Act of 1906, Dr. T. Lewis Bailey, the Chief Inspector, states that the total number of works registered was 1210, which entailed the inspection of 1990 separate processes. When comparison is made with the previous year, these figures show a reduction of nine in the number of works, but of five only in the total of separate processes. Three new works were found operating without having been registered. During the year there were 3792 visits of inspection paid to registered works. On this occasion Dr. Bailey has the gratification of being able to report that the number of special visits rendered necessary by complaints of nuisance received from local authorities and private individuals was considerably smaller than in each of the two previous years.

Mention is made of the severe loss suffered by the staff of inspectors through the death in April of Mr. H. J. Bailey, whose high sense of duty, it is said, undoubtedly contributed to his untimely decease. An unusually long round of visits of inspection, during which at one works he found it necessary to investigate the cause of an escape of sulphuretted hydrogen from a tar plant, was followed by a period of indisposition, apparently to him of insufficient gravity to prevent him from carrying on his duties; and this culminated in his sudden death ten days later. Mr. James Picken, B.Sc., A.I.C., was appointed to fill the vacancy thus caused.

Though the chemical industry of the country has not yet got back to what may be considered normal conditions, it is interesting to note a continuation of that general change of outlook which augurs well for the future. This, Dr. Bailey remarks, may be in part a natural sequence of lean years; but that it makes for true progress is evidenced already in the greatly altered, and at the same time improved, character of process outlines and details. The older and more cumbersome methods are, it seems, giving way to manufacturing systems more reminiscent of the laboratory, and with it all is disappearing very markedly the idea that chemical works must be of necessity places of peculiar squalor.

SULPHURIC ACID WORKS.

In sulphuric acid works, sulphur continues to be extensively used in place of pyrites; and at some works zinc blende is being employed with good results. Replacement of nitre potting by catalytic oxidation of ammonia, for the production of the oxides of nitrogen required in the chamber process, continues to extend. The introduction of the heat exchanger on the converter body has improved the efficiency; and the plant generally has been standardized, so that its operation is now of a simple and straightforward character. The scrubbing of exit gases by means of water in the second Gay-Lussac tower has been introduced at several works. It has, Dr. Bailey says, become obvious that, if this modification of older methods is to be successfully carried out, the quantity of water used must be strictly limited, and a reasonably clean tower must be employed. In the case of towers fouled by long use with impure acid, subsidiary reactions take place which do not exist apparently in the presence of strong acid. Where a clean packing is provided, the total acidity of the escaping gases is unusually low, and the weak nitrous vitriol produced can be returned to the system. Any reduction of exit gas acidity means an increase in acid production.

TAR WORKS.

In 1924 there were 378 tar works, which was an increase of 10 over the previous year; but many of the smaller plants, erected at gas-works, are for purposes of dehydration only. At the larger works, where operations extend to complete distillation to pitch, conditions have improved in a number of instances; but the need for preventing the running of the pitch to the bays at too high a temperature is again emphasized. Another point to which attention is once again drawn is the danger attending the cleaning of tar stills without absolute isolation from adjoining working stills. By an accident which could not have occurred had there been physical disconnection, three men were overcome while engaged on the cleaning of an idle still. A faultily introduced blank flange allowed foul gas to pass to the idle still when the operating stills were at the steaming stage. There were two fatalities at a works during still cleaning, and a preheater explosion at another works was responsible for the death of a workman; but in each case unusual conditions were in evidence.

What is regarded as a distinctly good feature which has been introduced at a number of works is mentioned in the report. This is an enlarged opening behind the pitch cock. By removal of the pitch cock and an attached plate, an 18-in. opening is available, which provides greatly improved ventilation of the still, and an easy means of getting rid of chippings. Moreover, it provides simpler and safer means of entry to, or exit from the still than does the upper manhole. It forms, in fact, a second manhole.

A great part of the report is devoted to further consideration of the question of the treatment of effluent spent liquors from the distillation of ammoniacal liquor; and Dr. Bailey says that, in the course of the investigations a fact emerged which would appear to be of peculiar interest to those engaged in the distillation of coal tar—viz., the totally different effects produced by solutions of free ammonia and by solutions of ammonium salts when agitated with tar. In the former case an emulsion of tar and liquor is produced, from which the tar separates only slowly, leaving a turbid liquor highly charged with oxygen-absorbing constituents; whereas in the latter case separation of tar and liquor results most readily, and appears to be complete, giving a supernatant liquor that is practically colourless and clear, and containing a relatively low amount of oxygen-absorbing constituents.

Tar Products Manufactured in 1924.

—	Gas and Coke Oven Works.	Other Works.
	Tons.	Tons.
Tar distilled	1,582,784	12,219
Pitch produced	541,546	5,791

SULPHATE OF AMMONIA AND GAS LIQUOR WORKS.

The number of sulphate of ammonia and gas liquor works registered remains practically stationary—564 sulphate works and 81 gas liquor works. The great development has been in the direction of synthetic ammonia and its products. With regard to the bye-product recovery of ammonia there is little to be said; complaints from outside have been very few.

It seems that further complaints as to the noxious character of ammonia plant effluents have been made in different parts of the country. The Department have, readers will remember, already done a good deal in the way of suggesting methods of treatment, whereby the oxygen-absorbing power of such effluents may be reduced; and now an important advance has been made by the adoption at two works of the suggestion that the devil liquor should be evaporated. This, Dr. Bailey says, can be done quite easily by spraying on to the bars of the producer fires, or by other available means. It was pointed out in the 1921 report that the devil liquor, though it may constitute only 10 to 15 p.ct. of the total effluent, contains nearly half the total phenol; and it is now remarked that it is obvious that such a simple method of getting rid of it as the one just mentioned has the effect in itself of considerably improving the works effluent. Attention has been paid at several works to other points raised in past reports, for example (*a*) the introduction of air, when this is considered necessary, at a later stage in the operations of coal-gas making than formerly; and (*b*) extraction of cyanogen. By these means, a further reduction has been effected in the oxygen-absorbing character of the ammonia plant effluent. Dr. Bailey then goes on:

"As to removal of phenol by means of fire-gases and steam in towers, one plant has attained a continuous removal of fully 90 p.ct.; and investigations are now in progress with a view to reducing the steam consumption, which in this case appeared to be unnecessarily high. But there is no doubt whatever that the logical course to pursue would be to obviate the production of excessively noxious effluents, rather than to obtain them, and then have to treat them by reason of their noxious character. The gas industry has changed in many directions of late years. In particular, the method of carbonization has been entirely altered by the introduction of vertical retorts; and yet comparatively little attention, speaking generally, seems to have been paid to the methods of removal of tar and ammonia from the crude gas. The repeated agitation of tar with ammoniacal liquor, which usually takes place, gives too much opportunity for the entry of soluble tar constituents into the ammoniacal liquor. This is much more evidenced in the case of the vertical retort system than in that of the horizontal retort system.

"It would appear that in the case of the newer systems much might be borrowed from certain features of coke-oven practice—such as early and more complete separation of tar by shock methods (the tar being then stored apart from the ammoniacal liquor), and more rapid cooling of the gas prior to ammonia scrubbing. We have this year to some extent considered these points; and investigations are about to be undertaken at two works on the effect of separation of tar at the hot end of the system. Moreover, it seems by no means certain that, with these newer methods of carbonization, the best way of recovering the ammonia—at any rate in large works—is that generally adopted. Is it not possible here also to borrow from coke-oven practice, and so reduce the amount of liquor produced and incidentally the amount of effluent from the works?

"These appear to be points well worthy of the consideration of the gas industry, especially when it is remembered that the old illuminating standard has been replaced by a calorific standard."

Details of the work done by the Department during the past year in connection with the subject under consideration

are included in the report, and will be reproduced subsequently in the "JOURNAL."

Amount of Ammonia Products Manufactured in 1924 (expressed as Sulphate, 25¾ p.ct. NH_3)—Tons.

From Liquor Produced in—	1924.	1923.	1922.
Gas-works	151,161	142,980	144,817
Other works (including coke-ovens, iron-works, producer gas, synthetic, &c.) .	211,019	185,016	130,484
Total.	362,180	327,996	275,301

NOTE.—Of the total quantity of ammonia products, the equivalent of 31,878 tons was manufactured as concentrated ammoniacal liquor; the balance of 330,302 tons consisted of other ammonia products (sulphate, chloride, nitrate, &c.).

Report for Scotland.

In the report which he has presented to the Scottish Board of Health, Mr. J. W. Young states that the number of works registered was 152, in which were operated 285 scheduled processes—including 13 gas liquor, 103 sulphate and muriate of ammonia, and 55 tar. There were 456 visits to these works.

Ammonia Products, Tar Distilled, and Pitch Produced.

—	Salts of Ammonia.	Tar Distilled.	Pitch Produced.
	Tons.	Tons.	Tons.
From gas-works	20,865	132,165	32,995
,, iron-works	5,940	62,616	34,845
,, coke-ovens	0,800	15,410	6,050
,, producer gas	25,520	8,534	3,995
,, shale-works	52,163	—	—
Total, 1924	91,288	218,725	77,885
In 1923	97,594	224,968	89,554

The ammonia is expressed as pure sulphate; but 980 tons were obtained as concentrated liquor ammonia, and 534 tons as ammonium chloride. Tar partially distilled for road material exceeded 100,000 tons.

With regard to sulphuric acid works, Mr. Young says that water sprays to supply moisture to the chambers continue to displace steam—an economy of fuel; but the supply of nitre by spraying in solution to a preliminary chamber does not extend. It is doubtful if this method deserved the earlier praise given to it. Oxidation of ammonia to supply nitric oxide has justified its recommendation for ease and regularity; and its use will increase. Messrs. Miller & Co.'s system, no longer an experiment, of flushing with water instead of with strong acid the second Gay-Lussac tower of their principal unit, has been maintained successfully in action.

SULPHATE AND MURIATE OF AMMONIA AND GAS LIQUOR WORKS.

At the larger works of this class, Mr. Young states, conditions of working and maintenance of plant have been satisfactory; but in some of the smaller works repairs have been neglected, with consequent escape of deadly gases. No serious effects on the attendants ensued; and in all cases immediate attention was given to the Inspector's warning, and defects were remedied. Four of the leakages were due to defects in the joint between the dome of the saturator and the ascending foul-gas pipe. This pipe is itself exposed to internal corrosion and severe strains. An improved method of attachment to the saturator, Mr. Young says, seems required. Elsewhere attention to general details has increased the yield of sulphate of ammonia by 5 lbs. on every ton of coal carbonized.

Increased corrosion of iron stills was reported when ordinary "purified liquor ammonia" had been replaced by a yet purer supply. Neutralization and drying of products continues; and Mr. Young adds: "The damage is recognized in appearance and substance that often follows complete elimination of moisture."

TAR WORKS.

Additional plants have been erected for the dehydration of tar, and others are nearly ready of types new in Scotland. Complete distillation of tar is diminishing; and competing materials have displaced pitch in road mixtures.

The report (which is the sixty-first of the series) is published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C., and branches, at the price of 1s. net.

Low-Temperature Distillation Plant for Milwaukee.—International Combustion Ltd. have received information to the effect that their associated Company, the International Combustion Engineering Corporation, of New York, have secured the contract for installing a large low-temperature distillation plant for the Milwaukee Electric Light and Power Company. The plant is to the designs and specification of Dr. Runge, Consulting Engineer to the International Combustion Engineering Corporation, who has been experimenting for many years with this subject, and has now developed and perfected a plant upon which important guarantees have been given.

THE STRACHE MIXED-GAS PRODUCER.

[Abstract from a Paper by M. A. Grebel before the Société Technique de l'Industrie du Gaz en France.]

Dr. Hugo Strache, of Vienna, recently read at Varsovie an important paper on this subject; and M. Grebel's communication is an adaptation thereof.

After an introduction directed to classifying the various grades of town gas commonly supplied nowadays, Prof. Strache went on to discuss the absolute necessity, from the viewpoint of coal conservation, of obtaining the maximum heat units in the form of gas, to which end he advocates gasification of the coke. The addition of water gas of course lowers the calorific power of the supply, but at the same time the cost of the heat unit is reduced, so that there hardly exists to-day a large gas-works without its water-gas installation. The cost of the heat unit might be further lowered by the admixture of producer gas; but the result of this is the overloading of the mains with nitrogen, which is worthless from the consumer's point of view, impairing the utility of the gas by reducing flame temperatures at the appliances. The author's opinion is that, providing adequate attention is given to the proper design and regulation of consumers' burners, reduction of the calorific power supplied can proceed by stages until one arrives almost at complete gasification—a small margin being left, representing the demand for domestic coke.

By complete gasification there is obtained a gross calorific value of 3200 to 3500 calories per cub.m. [362 to 396 B.Th.U. per c.ft.], and it is thus that the cheapest therm [1000 gas-calories are described as a "thermie-gaz"] can be produced and sold. Exceptions, of course, prove the rule; and many instances can be found where the market for coke is so favourable that its gasification is of little interest. At the moment, however, this economic situation is nowhere to be found.

The author refers to the present processes of coal gas and water gas manufacture as uneconomical, even where the stack gases are used for making steam. He submits that the heat wasted in the process is sufficient to serve for carbonizing the coal.

The Strache plant is of the type having a retort superimposed on a producer; and the whole installation is hardly bigger than the water-gas plant alone in a station of the same capacity making coal gas and water gas in separate plants. The Strache generator is shown in fig. 1. The coke in the lower part of the

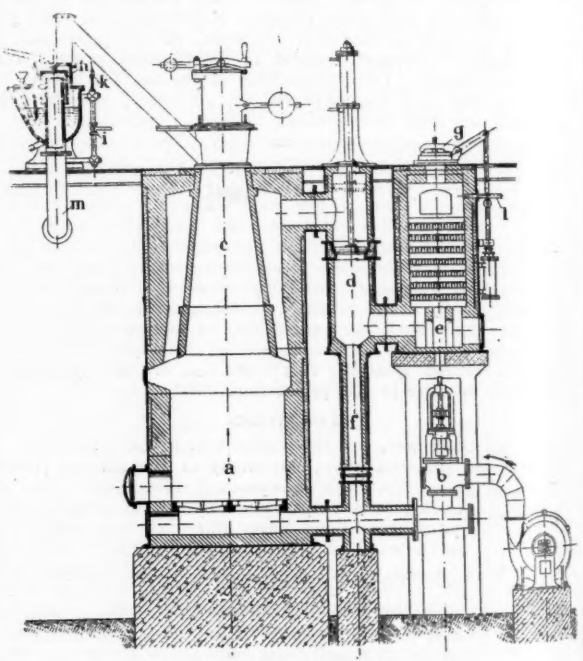


Fig. 1.—The Strache Mixed-Gas Plant.

producer A is subjected to an air blast through the valve B. The hot flow gases containing CO pass round the retort C, and thence by way of the reversing valve D to the bottom of the steam superheater E, where they are burned by the addition of secondary air through F. The superheater contains checker brickwork, which is raised to incandescence. The burnt gases escape through G to the stack. During the blow the bell H is lowered so as to seal the offtake M from the hydraulic main; but a by-pass with cock I provides a passage for the small quantity of gas given off in the retort during the blow, which lasts two minutes. A flame K gives the necessary warning to close the valve I, for as soon as blow gas begins to arrive in the by-pass the indicator flame goes out.

During the gas-making period which follows, the valves B, D,

and G are closed, and steam is admitted through L, passes through the superheater and thence through E and F to the bottom of the producer. Thence the hot water gas flows through the retort, and the mixed gas makes its way to the hydraulic main; the bell H having been raised. As soon as the temperature falls to a point at which decomposition of the steam is incomplete—this is automatically indicated—gas making is stopped, and another two minutes' run given. All valves are controlled hydraulically from a central position.

Of 28 installations built during the last five years, thirteen work in conjunction with straight coal gas plant, and fifteen stand alone and supply the mixed gas direct to the district. It is stated that certain very small undertakings have only been able to keep alive through adopting the Strache process, as costs are too high for them to work any other system.

Recent improvements to the plant include a flash boiler heated by the waste products after they leave the steam superheater, which, it is claimed, entirely eliminates an ordinary boiler and the expense of running it. Difficulties were experienced in finding a lining to stand up to the alternating flow of hot gases and water; but these have been solved by a material known as "Thermofix." [The paper vouchsafes no further information as to this.]

Various methods of enriching the gas are, of course, applicable to the Strache process, if a carburettor, heated by the blow gases, is added to the equipment. A value of 4000 calories per cub.m. is reached by using 100 grammes of oil per cub.m. of gas. Alternatively the "Infinikrak" process may be applied, whereby the tar itself is cracked to gas and coke; a normal gas coal thus rendering as much as 164 cub.m. of 3500 to 3600 cal. gas from 100 kg. (4000 cal./m³ with some special coals, but a smaller volume, of course). Particular stress is laid on a third method, in which a certain amount of clean coke has to be withdrawn from the producer for an external demand. The author works out the retort and the producer yields separately. Suppose 100 kg. of coal give 30 cub.m. of 5500 cal. gas and 70 kg. of coke, and half the latter is taken, the remainder will produce about 63 cub.m. of 2800 cal. water gas. At the carbonizing temperatures employed, he reckons to have 15 kg. of tar, which may be cracked to give 8 cub.m. of 7000 cal. gas. The result is about 100 cub.m. of 4000 cal. gas per 100 kg. of coal.

Fig. 2 is interesting. It shows the comparative sizes of a chamber-oven plant and a Strache plant of the same capacity

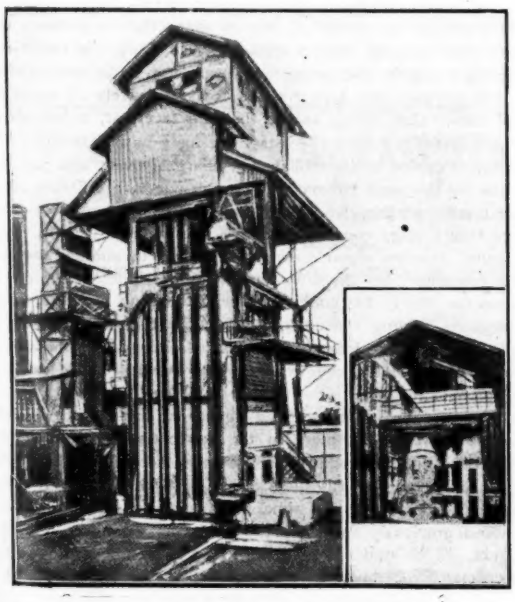


Fig. 2.—Comparative Sizes of Chamber Oven and Strache Plants.

in therms, both mechanically controlled. Fig. 3 illustrates the type of boiling burner which is recommended by Prof. Strache for the avoidance of back-firing with low-value gas. It is a

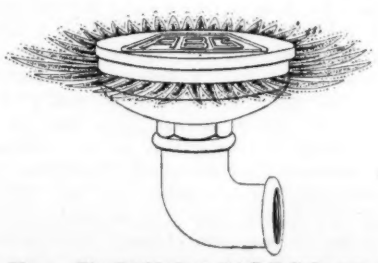


Fig. 3.—The Backhuizen "A.B.G." Burner.

fixed burner, and no air is admixed until the gas leaves the twin orifices. Made in two parts, the burner is very easily cleaned with a brush.

To the reproduction of Prof. Strache's paper, M. Grebel adds some information regarding the applicability of the processes to French gas-works practice. Without labouring the future possibilities of the manufacture, by the direct method, of "4-thermie" gas, with the production of the minimum of coke, he points out that the addition of the 3·3 and 3·6 thermie Strache gas to coal gas is an interesting proposition. Take coal gas of 5100 cal. and 8 p.ct. CO content, water gas of 2700 cal. and 40 p.ct. CO, Strache gas of 3300 cal. and 30 p.ct. CO, or 3600 cal. and 28 p.ct. CO. Working to a calorific value of 4500 cal., the volumetric proportion of coal gas to water gas must be 78 to 122, in order to keep below the statutory CO limit of 15 p.ct. Thus—

CO content . . . 0·78 × 0·08 + 0·122 × 0·40 = 15 p.ct.
Cal. value . . . 0·78 × 5100 + 0·122 × 2700 = 4572 cal.

With the mixed Strache gas, however, the proportion of coal gas to diluent becomes 68 to 32. Thus—

CO content . . . 0·68 × 0·08 + 0 32 × 0·30 = 15 p.ct.
Cal. value . . . . 0·68 × 5100 + 0·32 × 3300 = 4524 cal.

Working with enriched Strache gas, the proportion of coal gas falls further—viz., 65 volumes to 35 of rich Strache gas.

CO content . . . 0·65 × 0·08 + 0·35 × 0 28 = 15 p.ct.
Cal. value . . . . 0 65 × 5100 + 0·35 × 3600 = 4575 cal.

Freed from the yolk of Germany industry, the Strache processes have been able to develop and prove their soundness from the technical and commercial points of view. There are already 35 installations varying in capacity from 100 to 1000 cub.m. per hour now in course of erection or already functioning abroad; and M. Grebel considers that, as further good reports of their working come to hand, many plants may be installed in France as well.

National Physical Laboratory.

On Tuesday, June 23, to mark the twenty-fifth year of the opening of the National Physical Laboratory at Teddington, Sir Charles Sherington, President of the Royal Society, and Chairman of the General Board of the Laboratory, performed the opening ceremony of the new approach roads and entrance gates. In his speech he referred to the names of the new roads, which have been christened after Lord Rayleigh and the late Lord Kelvin. These names, he said, were very appropriate, for both these scientists had done a great deal for the Institution. Lord Rayleigh had acted as the first Chairman, and had shown his warm interest in the Institution ever since. There was present a large gathering of men eminent in science and invention or in the different services of the State, and many new phases of research work were demonstrated.

Origin of the Bunsen Burner.

At the April meeting of the American Chemical Society, Mr. L. M. Dennis, of Cornell University, stated in a contribution that about two years ago the Department of Chemistry of that University purchased a letter written on May 12, 1855, to Mr. Desaga by Prof. Robert Bunsen. Desaga at that time was the University Mechanician at Heidelberg, where Bunsen also was. The letter, of which the following is a free translation, makes clear, Mr. Dennis remarks, that the designer of the burner was Desaga, and not Bunsen: "Mr. Desaga, Mechanician in Heidelberg, has made a gas burner for heating which is based upon a principle that I suggested, and which has been constructed in an ingenious form of his own design. This burner gives a gas flame which, without the use of wire gauze, is non-luminous, and deposits no soot. At Mr. Desaga's request, I have tested these burners, and have convinced myself that they are distinctly superior to all previous forms of apparatus that have been used for this purpose. They are simpler and cheaper, and much more durable, than the usual wire-gauze burners, in comparison with which they afford economy in the amount of gas consumed, and yield a higher temperature with the same volume of gas. They also possess the great advantage that the flames that they produce are of a form that is much better adapted to scientific, technical, and economic uses. For these reasons, I regard the burner constructed by Mr. Desaga as a very valuable invention which without doubt will materially contribute to make more universal the use of illuminating gas for heating purposes."

Liquid Fuels from Water Gas.—Herr Franz Fischer, of Mülheim, recently described before the Gas and Fuel Section of the American Chemical Society proposals for the production of liquid fuels from water gas. After discussing the various known reactions with carbon monoxide and different catalysts, with reference to their possible use in devising a process for the production of synthetic fuels, means are suggested for the formation of synthetic methanol, a mixture of synthetic alcohols called "Synthol," and from the latter a mixture of products termed "Synthin."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Public Street Lighting and Illumination Commission

Sir,—Owing to the want of time at the Wednesday morning meeting of the Institution of Gas Engineers, when Mr. Robert Watson, of Doncaster, gave his summary of the report of the Sixth Session of the International Commission on Illumination held at Geneva in June and July last year, I was precluded from making any remarks; but availing myself of the accustomed courtesy of the President to forward my contribution to the discusson for publication, I take this opportunity of bearing my testimony to the time and labour given by Mr. Watson. I would specially emphasize the wish that the Institution will not go back on the good work to which it has put its hand, but will continue to support financially and by representation the work of the Commission, more particularly as far as street lighting is concerned, where there is much work yet to be done in the Sectional Committees, and likewise in the Committees of the British Engineering Standards Committee dealing with this matter. The abridged report presented by Mr. Watson, running to some 32 pages, is full of useful information, and should be read quietly and carefully by every member of the Institution, as it could not possibly be discussed in the limited time at the disposal of the meeting.

The newly-formed Institute of Public Lighting Engineers has this matter of street lighting, in its connection with the Illumination Commission, naturally before it, and has two representatives upon the Street Lighting Sectional Committees of the British Engineering Standards Association, of which I am privileged to be one. As we are being reminded at the forthcoming Conference at Brighton that "over 90 p.ct. of the roads and streets in this country are not sufficiently lighted to ensure the safety of the public," and "that in the case of street lighting it will be found that with few notable exceptions the position remains very much the same as before the war," it will be seen how necessary it is that this section of the work of the Commission should go on. It concerns every gas engineer, owing to the fact that Great Britain, being an old country (from a public lighting point of view), has its roads and streets in the cities and the countryside to a large extent gas illuminated. The rapidly increasing mechanically propelled traffic thrusts upon those responsible the necessity for safeguarding life, as well as brightening our streets and protecting property. I therefore echo Mr. Watson's plea for an increased interest in the subject by the members of the Institution and those connected with public lighting generally.

Our hearty thanks are due to Mr. Watson for the assiduity and intelligence that he has brought to his task.

W. J. Liberty.

June 18, 1925.

Electricity for Heating.

Sir,—I have been unable to reply earlier to your comments in your issue for June 10, due to my attendance at the I.M.E.A. Convention.

In the first place the calorific value of coal referred to, costing 0·1d. per lb., is 11,000 B.Th.U. Therefore the efficiency is 12½ p.ct. instead of 10½ p.ct.

The comparison was not made with gas at ordinary rates, but at ordinary rates *less* 35 p.ct., which is a vastly different matter.

I certainly do claim that the supply given to Wick Lane Baths is a business transaction. If I can obtain a load which I could not possibly get unless sold at a cheap rate, and the price obtained shows 50 p.ct. over the actual cost of production, it would be most unbusinesslike on my part to refuse to supply.

I can assure you that there is no question of preferential treatment, as I would be perfectly willing to supply any user under similar conditions on the same terms. I can also assure you that the Poplar Borough Council would be prepared to supply electrical heat on the same terms for *any* purpose if the supply is made under similar conditions.

I cannot understand your reasoning when you state that cooking for dinner is carried out between noon and 2 p.m. During this period factories shut down to a large extent when workmen are at dinner, but the cooking must be done beforehand, and not during the dinner period. It would be interesting to know at what hour of the morning the demand for gas is at its highest. I think we would find little difference between that and the demand for electricity. However, now that you have raised the point, I may say that there is no reason why electrical heat for cooking purposes should not be supplied as cheaply as gas. Do not for one moment think that it is the cost of electricity that prevents electricity supply undertakings entering into serious competition with gas for cooking purposes. The reason for the delay is in the hands of the manufacturers of cooking appliances; and I frankly admit that we have not yet reached that stage of reliability which would warrant an undertaker investing large amounts of capital in electric cookers. But I am sure that the day is not far distant when a reliable cooker will be introduced. When this does arrive, gas will have a healthy competitor in electricity.

There are very few heating purposes to-day for which gas can claim superiority over electricity, either in efficiency or cost; and I again repeat that it is cost that must have first consideration. I would particularly call your attention to electrical bread baking, which has many advantages over gas, coke, or coal ovens.

You take exception to my term of "bye-product" as applied to off-peak loads. Perhaps you will be good enough to define what a "bye-product" really is. In my opinion it is something that can be produced which would not otherwise have been produced without the staple product. You cannot compare electricity with gas, because you do not consume electricity, but use it as an agent for transmitting light, power, and heat.

At the outset, electricity supply was commenced for lighting only, and that was the staple product. Later it was found practical to supply power at much lower rates than light; and to-day light and power combined form the staple product. But electricity undertakers are now realizing that it is practical to transmit heat at very much lower rates than light and power; and while they have the plant and mains available, and the supply can be given without material addition to cost of generation and distribution (other than fuel), the supply of heat will continue to be a bye-product until a load factor of 100 p.ct. is reached.

Similar views prevail in the mining industry. The staple product is large coal, but there are many stages in grades of coal down to colliery waste, with values governed by the prices they fetch in the market. The cost of grading these coals is not imposed upon the lower grades, but upon the higher grades; yet we have no quarrel with the colliery owners in that respect.

It appears to me that you base your arguments upon the relationship of thermal values of gas and electricity to that of coal; but in my opinion you are starting at the wrong end. The efficiency that matters is the efficiency in use. As we all know, the most inefficient method of obtaining light and power and heat is by burning raw coal; but can you, or anyone else, tell what the relative values of actual work done really are? It is impossible to state these in terms of thermal values; and I contend that the only comparison to be made is that of cost. If electricity can be supplied for any purpose as cheaply as gas, the user will give preference to electricity every time, without bothering about how many B.Th.U. are expended in its production.

I am pleased that you are not "shivering" over the prospect of raising steam from colliery waste, and I have called the attention of the plant manufacturers to your suggestion for using a proportion of gas coke; but unless this is a "waste product" I do not see the utility of it.

I do not think Mr. Jefferson Hope is much concerned with the question of "extravagant heat expenditure for raising the temperature of water by electrical energy." All that concerns him is that his bath water is not costing more than by using gas, and his repairs are costing very much less, and his attendants have less attention to give, and certainly work in a purer atmosphere.

J. Horace Bowden,
General Manager and Chief Engineer.

Electricity Works, Glaucus Street,
Bromley-by-Bow, E. 3,
June 22, 1925.

[We are much obliged to Mr. Bowden for his letter, which aptly illustrates the proneness of men to shape their arguments to suit their own interests and conditions. And truly the conditions of electricity supply and prices which attempt to be competitive for certain purposes are such that they oppose entirely all sound financial laws. One cannot escape the bald fact that, unless the price of a commodity covers all costs from fuel, manufacturing expenditure, and capital and establishment charges, those who pay higher prices for the same commodity, though put to a different purpose, pay more than they would otherwise have to do. We do not dispute that a large consumer through one main and meter, and one account, deserves consideration as opposed to another less profitable consumer; but the difference of several hundred per cent. between the charge for public bath water heating in Poplar and the charge to lighting consumers needs more than the argumentative skill of many Bowdens to justify it. Dealing with the points of the letter, we must congratulate Mr. Bowden upon losing only 87½ p.ct. of the original heat value of his coal, instead of 89½ p.ct., as estimated by us on assumed figures in the absence of definite ones, and then a bit more in the application of the commodity. As to the point that comparison was made not with gas at ordinary rates, but at ordinary rates less 35 p.ct., "which is a vastly different matter," this is the first time that has been stated. What Mr. Bowden previously said was that the Gas Company refused the 35 p.ct. off the standard price until they became aware of what the Electricity Department were doing. Accepting that statement, the 35 p.ct. is small compared with the percentage difference between the ordinary lighting rates for electricity in Poplar and the charge for electricity for heating the public bath water; and it really has very little effect upon our point that comparison is absurd between a price for electricity representing only the average cost of coal per unit and the ordinary price of gas—less, if you will, 35 p.ct. In his paper, Mr. Jefferson Hope stated that the comparison was made with gas at 3s. 9¾d. per 1000 c.ft., or 9·15d. per therm, while the Electrical Engineer agreed to supply current, at off-peak load times, at "a little over station fuel costs." The point which we made was that on such an unfair basis it was not true to assert, as was done, that the heating of water by electricity is cheaper than by gas. Now Mr. Bowden alleges he is receiving for this supply "50 p.ct. over the actual cost of production." This depends upon the items included in "the actual cost of production." In his last letter he said he was charging at the "average cost of fuel." The "actual" cost and the "average" cost of fuel appear to be different things—in

Poplar. In Mr. Bowden's last letter, the "actual" cost of fuel is put at 0·25d.; and *plus* conversion and distribution, 20 p.ct., the "actual" cost is 0·3d. But it is added: "We are charging at the 'average' cost of fuel, which is 50 p.ct. greater." That is the point; if the "average" cost of fuel is 0·45d., and that is what is being charged, then neither can the charge meet the other costs over and above the average price of fuel, nor can the 50 p.ct. be over the "actual cost of production," without eliminating charges which other consumers have to pay. The Poplar electricity station could not live on such methods of business alone. The only other essential point in the letter which requires touching upon is Mr. Bowden's view that the supply of electricity for heating purposes is a "bye-product," while lighting and power combined form the staple product. The suggestion is delightfully specious, and is merely adopted for defensive purposes. We might urge the same for gas, but decline to do anything so ridiculous. The staple product of the electricity industry is electricity, and not the purpose or purposes to which it is applied; the same as gas is the staple product of the gas industry. It is (to use a mild expression) a strange idea to take coal as an analogy. "The staple product," Mr. Bowden says, "is large coal; but there are many stages in grades of coal down to colliery waste, with values governed by the prices they will fetch in the market. The cost of grading these coals is imposed, not upon the lower grades, but upon the higher grades." Size is not the only thing that counts in the grading of coal. Calorific value, moisture, and ash content affect considerably its value in the open market. The high grade coal would not be worth so much to the user if mixed with the inferior grades; and therefore would not command such good prices. But what of electricity? There are in it no different grades. All electricity possesses per KW. a potential heating value of 3420 B.Th.U.; and the value in useful effect that the user obtains merely depends upon the purpose to which the thermal energy is applied. Such electrical defensive wriggling as we have in this letter does not assist much in producing justification. We are interested and amused by the aerial flight Mr. Bowden makes over the question of efficiencies in the utilization of coal and the products therefrom. What he says in this regard shows how easily an engineer can make a departure from scientific principles, if it suits his purpose, in the attempt to provide an argument. Perhaps we ought to express pleasure that he has thought it well not to endeavour to controvert the figures which in this regard we put forward in dealing with the subject—"Poplar Washes and Wastes."—ED. "G.J."

REGISTER OF PATENTS.

Automatic Control of Lighting Burners.
No. 216,509.

CIE. POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ, of Montrouge

No. 11,862; May 13, 1924. Convention date: May 24, 1923.

This invention, relating to clockwork apparatus for lighting and extinguishing gas burners, seeks to avoid the disadvantages of a permanently burning pilot light and of electric contacts always situated in a zone of intense heat. The apparatus, in which the lighting of the main burner is produced by a pilot light, itself electrically lighted, comprises a clockwork which produces, at the times for lighting and extinguishing, the rocking of a lever carrying an obturating valve, which rocks between a seat terminating the main gas-inlet pipe and a seat terminating the pipe line of the pilot light; the movement of the lever controlling a switch arranged in the lighting circuit of the pilot light.

Calorimeter.—No. 222,839.

DORGELO, J. I., of Delft.

No. 19,896; Aug. 22, 1924. Convention date: Oct. 1, 1923.

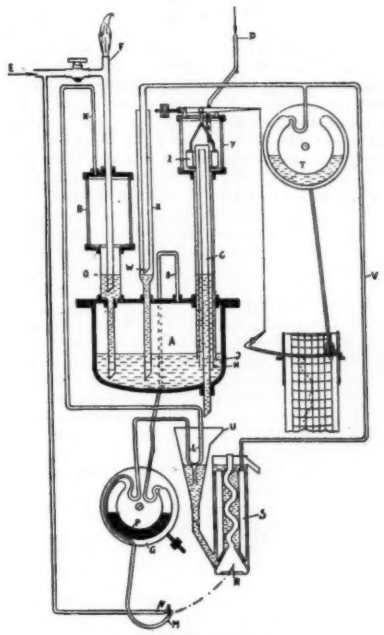
With this calorimeter, for each measurement a constant volume of gas is burnt, in a device having a constant water equivalent, in periodic stages; the quantity of heat liberated each time is measured; and all the separate operations required for this purpose are automatically interdependent.

Referring to the drawing, the hollow body A supplies the power, and to it are connected the cylinder B, which serves as a measuring burette, and the water inflow and syphon arrangement C. Water is admitted at D; the testing gas flows in at E and burns at atmospheric pressure on a branch pipe F. In front of a cock on a branch of the pipe F, a capillary tube is branched off and terminates, near the change-over apparatus G, in a small continuously burning ignition flame.

The determination of the calorific value is carried out as follows: As soon as the water flowing at D into the vessel A has reached the tube J, the air in the vessel A is shut off from the atmosphere. The water subsequently flowing into the vessel A compresses the air in the vessel, which forces the greater part of the subsequent supply of water up to the cylinder B and tubes X, C.

As soon as the water has reached the lower end of the tube F, the gas in the cylinder B can no longer escape into the atmosphere through the tube F, and is forced to escape through the system of the tubes K, L, M, being ignited at M by the flame N. As with each measurement an equal volume of gas is forced out from the cylinder B, the same volume of gas is burned in each measurement. As the air in the vessel A is prevented from escaping, it is compressed by the inflowing water. The pressure that is produced is transferred through the pipe O to the mercury in the annular pipe P of the change-over device G, so that a constantly increasing displacement of the mercury takes place.

The change-over device G is rotatably mounted, and is so adjusted as to tilt at the moment in which the water reaches the level Q in the cylinder B. By this tilting motion the flame of the tube M is brought under the calorimeter R and burns in this position until all the gas has been forced out of the cylinder B. The amount of heat liberated is transmitted to the calorimeter R. The air enclosed in the tube S expands in accordance with the rise in temperature, displacing the liquid in the rotatable registered pressure gauge T, which rotates



A Dutch Calorimeter.

in accordance with the displacement of the liquid. A dry pressure gauge may of course be used in place of the liquid pressure gauge.

As soon as the water in the syphon C has risen so high as to flood the syphon tube, it is syphoned off rapidly into the beaker U, and flows through the calorimeter R, displacing the heated water in the same. The air pressure in the vessel A decreases and the cylinder B fills up again with fresh gas. Simultaneously with this decrease in pressure, the mercury in the tube P returns to the former level, and the device G swings the ignition tube back again to its initial position.

In order that air shall not be sucked into the cylinder B through the system of tubes M, L, K during the syphoning operation, this system of tubes is automatically closed by the forked part at L during the filling of the cylinder B. This forked part is provided with an opening below, so that, during the syphoning operation, the accumulation in the beaker U causes water to enter the two limbs, thus closing the tube. This accumulation only lasts as long as the water flows out of the syphon, and consequently only until the cylinder B has been filled. The levels in the beaker U and the calorimeter R will then be equal again, and the tube leading to the burner will be free.

The calorific value is obtained from the formula

$$\frac{\text{Water equivalent} \times \text{difference of temperature}}{\text{Volume of gas.}}$$

As in the apparatus described the volume of gas and the water equivalent are constant, the difference of temperature before and after heating is proportional to the calorific value. This difference of temperature is determined by means of a simple pyrometer in the following manner.

The hollow cylinder S (air pyrometer) is connected on the one hand by the capillary tube V to the registering pressure gauge T, and on the other hand by the extension of the tube V to the atmosphere at W. The opening W extends into an enlarged tube X, one end of which is immersed below the water level in the vessel A. The tube V is open at W until the water has reached the height of the mark Q. It is closed at the moment at which the flame is swung under the calorimeter, and is kept closed until the registering is complete and the water is syphoned off. By the periodic opening of W the pyrometer is always set to zero until the commencement of the next measurement.

The effect of the periodic sequence of analysis would be that the registering device T would make a stroke for each analysis, the length of which would correspond in each case to the heat produced in the calorimeter R. All these strokes would, however, tend to make the chart illegible and would cause a great waste of ink. In order

to prevent this and to produce the semblance of a continuous line, a float Z is provided in the vessel Y and a registering device co-operating with it. The pen on the lever arm of the registering pressure gauge T is so balanced that it does not touch the diaphragm. Only at the moment in which the float Z is raised by the rising water, as immediately before the syphoning off of the water, the float, by means of a motion transmitting device, presses the pen on the paper. On syphoning taking place the float immediately drops into its original position and liberates the pen, and the pressure gauge T returns into its initial position.

Manufacture of Combustible Gas.—No. 233,038.

LOEBELL, H. O., of New York.

No. 2567; Jan. 31, 1924.

This invention relates to the intermittent method of making water gas, by which a high temperature is maintained in a definite portion of the fuel bed by intermittently blasting air therethrough and then treating the fuel bed with steam to make gas, the fuel being continuously passed through the high-temperature zone.

The patentee points out that for producers having a comparatively small cross-sectional area at the high-temperature blast zone, the old method of making gas will give very high thermal efficiencies and an excellent heat balance. It has been found, however, that when using a producer having a large cross-sectional area, to provide a large gas-making capacity, the blast gases contain too much potential heating value to give the proper heat balance. This is due to the fact that a passage of air through a deep fuel bed will form a high percentage of carbon monoxide. At the time the air blast first enters the fuel bed, carbon dioxide is formed; and then as the latter passes through the fuel bed it is reduced to carbon monoxide. If blast gases containing carbon monoxide are burned in a regenerator, the heat of combustion and the sensible heat of the blast gases will provide a much larger volume of heat than is necessary to pre-heat the air for blasting, and therefore the blast gases must be discharged from the regenerator hot, and deleterious temperatures may be developed in the regenerator.

One object of the present invention is to provide a method of, and apparatus for, making water gas by use of which high thermal efficiencies may be maintained regardless of the size of the fuel bed; and one feature contemplates storing in a regenerator the sensible heat and the heat of combustion of the blast gases in such a manner that the heat may be utilized to vaporize water to form steam for use in the gas-making operation. Another feature contemplates the provision of regenerators by which the heat of the blast gases may be carried back to the fuel by pre-heating the air used for blasting and by super-heating the steam used for gas making. (It is not novel *per se* to super-heat the steam and the primary and secondary air in a regenerator.) A further feature is the control of the temperatures and the position of the heat storage in the regenerator.

It is further remarked in the introduction to the specification that operating experience has shown that no particular advantage may be gained in developing very high temperatures (above 2700° Fahr.) in the fuel bed, because the increased rate of formation of gas and the extra volume of gas which may be obtained at the very high temperature are not large enough to offset the damage caused to the producer linings and trouble caused by the formation of clinkers. Accordingly, another object of the invention is to provide a method and apparatus by the use of which the temperatures in the fuel bed may be controlled to give a high gas-making efficiency and a large gas-making capacity, by the circulation of blast air and gas-making steam through the fuel column in such a manner that endothermic reactions will be maintained throughout substantially the entire length of the high-temperature zone. It is also sought to provide for wide variation and accurate control of the quality of the gas.

Broadly, the invention consists in a method of making combustible gas comprising passing fuel in a column downwardly through a producer, maintaining a high-temperature zone in the mid portion or lower portion of the column by blasting air therethrough, generating steam directly from heat regenerated from the blast gases (that is, by supplying water to regenerators previously heated by combustion therein of combustible blast gases as well as by their sensible heat) and/or from the waste fuel in the bottom of the column, and passing the steam as formed into the high-temperature zone of the fuel column. The method may be completed by passing gas formed by the steam through the upper portion of the fuel column. The fuel may be passed in a column downwardly at such a rate that unburned fuel will be discharged therefrom while blasting primary air downwardly, maintaining endothermic reactions in a major portion of the zone, and introducing water into the lower portion of the column. Blast gases may be exhausted into a regenerator and burned with secondary air; steam being formed from water admitted into the pre-heated generator, and being passed into the bottom of the blast zone.

The specification is fully detailed and illustrated, and there are twenty-one claims.

Gas Ovens.—No. 234,312.

HELPS, G., of Nuneaton.

No. 16,435; July 9, 1924.

Stating that his object is to allow the products of combustion to leave the oven near the burners without interfering with the flame, the patentee claims a gas cooker or oven, normally closed at the top and sides, but open at the bottom, and having a burner whose flames require secondary air and from which the products of combustion pass into the oven, in which the burners are situated so far below the back, front, or sides of the oven that the products of combustion can pass out between the lower edge of the oven and the burner or flame.

The burners project through openings in the oven walls, but do not entirely close the openings.

Geysers.—No. 234,730.

EWART, J. W., of Crouch End, N. 8.

No. 31,001; Dec. 24, 1924.

According to this invention, the pilot burner of a geyser is rotatably mounted and is operated by gearing from the handle of the gas tap. In a suitable arrangement it is carried by a socket or body rotatably mounted and fitting on a hollow plug, the socket being rocked on the plug by the controlling lever or handle of the gas tap by teeth on the said handle meshing with teeth on a wheel or disc on the socket. The passage through the plug forms part of the by-pass, and opens to a peripheral port or passage in the plug; provision being made for hand manipulation to take up back-lash between the teeth, which allows a slight movement of the socket on the plug independently of the tap handle.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for June 17.]

Nos. 14,789-15,427.

BACK, P. E.—"Geyser, &c." No. 14,946.
DUCKHAM, Sir A. M.—"Vertical retorts." No. 15,127.
EWART, J. H.—"Water and gas supply valves of water heaters." No. 15,372.
HANNAM & STEWART.—See Back, P. E. No. 14,946.
HARDY, J. T.—"Street, &c., lamps." No. 15,057.
HELPS, G.—"Gas burners." No. 15,239.
LYNCH, H. L.—"Gas ovens, &c." No. 15,242.
POPHAM, C. A.—"Apparatus for using water gas, &c., in furnaces." No. 15,044.
SANDY, W. J. L.—"Gas ovens, radiators, &c." No. 15,090.
SCHLÜSSELBURG, G.—"Valves for regulating gas flames." No. 14,880.
SPENCER, S. E.—"Grids for gas purifiers." 15,156.
WOODALL-DUCKHAM (1920), LTD.—See Duckham, Sir A. M. No. 15,127.
YEO, O. E.—"Water gas producers." Nos. 15,105, 15,173.

[Extracted from the "Official Journal" for June 24.]

Nos. 15,428-16,014.

ADAMS, M. J.—"Gas-mantle guard." No. 15,443.
ALLENDER, J. J.—"Gas fires, &c." No. 15,542.
ASHMAN, G. R.—"Gas grill." No. 15,987.
CHAVANNE, L.—"Gasification of solid fuel." No. 15,997.
DUFFIELD, F. L.—"Production of gas from pulverized fuel." No. 15,507.
HACKSTROH, P. A. M.—"Gas valves." No. 15,589.
HELLIWELL, F. O.—"Gas cooking stoves." No. 15,719.
KEULEN, O. VAN.—See Hackstroh, P. A. M. No. 15,589.
LAING, B.—"Manufacture of gas." No. 16,014.
LECHLER, P.—"Interior protection of gasometers, &c." No. 15,585.
LEGAT, A. A.—"Protection of gaseous fuel from air." No. 15,674.
M'LAREN, E.—"Apparatus for carburetting coal gas." No. 15,539.
NIELSEN, H.—See Laing, B. No. 16,014.
OAKLEY, P.—See Allender, J. J. No. 15,542.
PARKER, C. H.—"Distillation of coal, &c." No. 15,826.
PLUMBRIDGE, W.—See Helliwell, F. O. No. 15,719.
RICHARDSON, W. H.—See Allender, J. J. No. 15,542.
SARGENT, D. F.—See Legat, A. A. No. 15,674.
WITTLETON, G. R.—See Legat, A. A. No. 15,674.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

South Metropolitan Gas Bill, and the Stockton-on-Tees Corporation Bill: Referred to a Select Committee to meet on the 13th inst.

Bolton Corporation Bill: Reported, with amendments.

On behalf of the Brighton and Hove General Gas Company, a petition has been presented against the New Shoreham Harbour Bill.

Gas Regulation Act.

The draft Special Orders proposed to be made by the Board of Trade under section 10 of the Act, on the application of the Harrogate Gas Company, Hastings and St. Leonards Gas Company, and the Preston Gas Company, were approved on June 25, on the motion of Viscount Peel. A similar motion proposed by Sir Burton Chadwick in the House of Commons was agreed to.

HOUSE OF COMMONS.

Progress of Bills.

Mansfield Corporation Bill: To be read a second time.

Gas Regulation Act.

The draft Special Order relating to the Colchester Gas Company was approved, on the motion of Sir Burton Chadwick.

Coal (Economical Conversion).

Mr. RENNIE SMITH asked the Prime Minister whether the Government propose to take any action with regard to the more economical conversion of coal into heat, light, and power?

Mr. A. CHAMBERLAIN replied that the question was receiving careful consideration, but that he was not yet in a position to make any statement.

BOLTON CORPORATION.

This Bill was considered by the Unopposed Committee of the House of Lords (presided over by the Lord Chairman, the Earl of Donoughmore) on Tuesday, June 23, and ordered to be reported for third reading. The gas clauses were referred to in the "JOURNAL" for Jan. 21 (p. 142) and March 25 (p. 751). The clauses were approved, and the one recently agreed between the National Gas Council and the Railway Companies, with regard to the supply of gas for other than lighting and domestic purposes from mains of insufficient capacity, was inserted.

STATUTORY GAS COMPANIES (ELECTRICITY SUPPLY POWERS) BILL.

This Bill came before the House of Lords last Thursday, and after debate was read a second time, and committed to a Committee of the whole House.

Lord RAGLAN, in moving the second reading of the Bill, explained its objects (which have already been given in earlier issues of the "JOURNAL"), and said that the present position was that in many of the rural districts of England people were becoming awake to the fact that electricity, as a means of supplying light, was more satisfactory than gas, and many of the statutory gas companies were willing and anxious to supply such electricity out of their superfluous power. As things are now, before they could do this, they had to promote a Bill in Parliament, and the cost of promoting such a Bill was in some cases prohibitive, and especially so in the case of the smaller companies. As to the larger companies, they had in twenty-four cases promoted such Bills, and these powers had been granted to them by Parliament.

Lord BANBURY OF SOUTHAM opposed the Bill on the ground that it took away from Parliament powers which it has exercised almost from time immemorial, and bestowed them on the Electricity Commissioners, who were practically responsible to no one. The Commissioners, if the Bill passed, would be able to grant concessions which have a pecuniary value, and that power might be subject to corruption. Not only had they power to grant concessions to these gas companies to supply electricity, but also power to grant them permission to borrow money and to raise capital. He was not against these various gas companies having these powers, but let them obtain them in the ordinary and proper way. He had a statement given to him by the promoters of the Bill. They said that already twenty-four gas companies have got these powers in the ordinary way. He hoped their Lordships in rejecting the Bill would do it not because they objected to the companies having the powers they desire, but because they should obtain them in the proper way, and that the control of Parliament (which is a valuable control, and has been in existence for many years) should still continue.

Viscount HALDANE inquired why it was sought to bring these gas companies within the scope of the operations of the Electricity Commissioners. He was far from hostile to gas or to the gas companies. He thought that in the end it would be proved that they would co-exist along with the suppliers of electricity, and that there would be two very valuable adjuncts to the public interest. He was not prepared to say that any gas company could take the position of an electrical supply company or an electrical supply authority.

Earl DONOUGHMORE, replying to Lord Haldane, said that a gas company who obtained powers through the Bill would come in under the Electric Lighting Acts, and would supply electricity in the same way as either a municipal corporation or a public company would supply electricity, and, of course, they would come in under the scheme of the Electricity Acts. Lord Banbury raised the point that this ought to be a Private Bill subject to Private Bill procedure, and not a Public Bill, but he was convinced that this was an erroneous view. Certain figures had been quoted. It had been stated that in either 21 or 24 cases Parliament had given power to authorities to supply both gas and electricity. It was fair to say he thought that this figure was independent of municipal authorities. There were scores of municipal authorities in the country who supplied both gas and electricity, and it was a public convenience that they should do so. He did not foresee any danger in giving these powers to the Electricity Commissioners. In giving power to enable gas companies to apply to the Electricity Commissioners to make Special Orders authorizing them to supply electricity, Parliament had not finished with the matter. These Special Orders remained subject to the approval of Parliament in each individual case. On the question of principle, there was no doubt whatever that Parliament was willing in particular cases that the same authority should supply both gas and electricity, and he believed wisely so.

Viscount PEEL, speaking from the point of view of the Ministry of Transport, stated that he did not suppose that the effect of this Bill would be very large. What he understood was that there were in some parts of the country areas not really supplied with electricity at all, and where, he thought rather as a temporary measure, it might be convenient for the gas companies to raise money or apply some of their money to the supply of electricity for those who wanted it. He did not think there could be any harm in passing the Bill, knowing that the larger points would be fully safeguarded by the Electricity Commissioners.

Lord RAGLAN said that the difficulty in the way of statutory gas companies obtaining electricity powers was felt more than ever at the present moment, owing to important developments in connection with the cheaper production of electricity, by which surplus heat arising from the process of gas manufacture, which had hitherto been wasted, was now being utilized for the generation of electricity. This process was now being largely adopted in large gas-works—such as the Gas Light and Coke Company—for the production of electricity for use in their own works. Smaller companies had no use, or very little use, for electricity in their gas-works, but the surplus heat referred to could be utilized for generating electricity for the purpose of a public utility supply, at a cost, too, at which it would be quite impossible for an electricity company, operating on a similar scale, to generate.

The Bill was read a second time, and committed.

ROCHDALE CORPORATION BILL.

This Bill was considered last week by Section B of the Local Legislation Committee of the House of Commons (presided over by Sir Joseph Nall). The clauses relating to the gas undertaking of the Corporation (see "JOURNAL" for Jan. 28, p. 210, and April 8, p. 130) were approved. Originally the Bill contained the old form of clause relieving the Corporation from the obligation to supply gas for other than lighting or domestic purposes from mains of insufficient capacity; but this has been deleted, and there has been substituted the clause recently agreed between the National Gas Council and the Railway Companies.

BATH CORPORATION BILL.

This General Powers Bill, which has been under consideration by the Local Legislation Committee of the House of Commons, contains clauses for the protection of the Bath Gas Light and Coke Company. Some of the powers sought by the Corporation relate to street works, &c.; and originally the Gas Company petitioned, with the object of obtaining suitable protection against damage to their apparatus caused in the carrying out of these works by the Corporation. The petition was withdrawn, however, on the insertion of clauses satisfactory to the Company.

One of these is of the usual nature, under which the Corporation are to give notice to the Company before carrying out proposed works which will affect their apparatus. Another clause provides that if the Corporation add to a roadway any portion of a footway in which there is apparatus of the Company, the Corporation are to alter the position of the apparatus as may be reasonably required by the Company, or, at the option of the Corporation, shall provide, in such position as may be reasonably approved by the Company, apparatus equally suitable in lieu thereof, in such manner as not to cause interruption in the supply of gas without the consent of the Company.

BURNLEY CORPORATION BILL.

Section A of the Local Legislation Committee of the House of Commons (presided over by Sir Thomas Robinson) have been considering this Bill for some days. (The clauses relating to the gas undertaking were dealt with in the "JOURNAL" for Jan. 21, p. 142.) These clauses were first considered by the Committee on Tuesday, June 16. There was some discussion as to the clause authorizing the adoption by the Corporation of the Sale of Gas Acts of 1859 and 1860; the appointment of an inspector or inspectors of gas meters; and the provision and maintenance at their gas-works of a station, with all necessary apparatus, for testing such meters.

Mr. MAURICE FITZGERALD (Counsel for the Corporation) said that originally it was proposed that the Corporation themselves should have this power, but it was suggested by the Board of Trade that, in conformity with the Acts mentioned, the proper course was that the power should be given by the Borough Justices. In pursuance of this suggestion, the matter was placed before the Justices of the Borough, and their approval obtained to the insertion of the clause. The practical effect of the Corporation being able to adopt these Acts was that the Justices could authorize the Corporation to appoint a gas inspector and establish a gas testing station in the Borough.

Mr. *James Clegg* (Gas Engineer and Manager), in evidence, said that unless there were a testing station in the Borough, it would be necessary, probably, to take the meters to Manchester. The nearest stamping station was Blackburn, and this station was hardly large enough to cope with an increased number of meters such as Burnley would have to deal with. The number of meters which came into the works annually for repair was 2500, and the cost of establishing a suitable station in the Borough would be about £1200, including premises to accommodate testing appliances.

Replying to the Chairman, in regard to the cost of the inspector and testing station, witness estimated that £150 a year would clear everything.

The clause was approved.

Another clause which was the subject of discussion was one by which it was proposed to increase from £5 to £10 the amount of compensation which might be recovered summarily by the Corporation, under section 20 of the Gas-Works (Clauses) Act, 1847, from any person who, carelessly or accidentally, broke, threw down, or damaged any pipe, pillar, or lamp belonging to them, or under their control. Counsel explained that the Home Office, though they took no objection to the proposed increase in respect of damage caused negligently, had pointed out that, under the common law, a person was not necessarily responsible for damage done accidentally, and had suggested that, in so far as section 20 of the 1847 Act varied the common law, its extension was undesirable. It was pointed out by Counsel, however, that up to the present the Corporation had been in the position that, if anybody damaged any lamps, wilfully, negligently, or accidentally, they could adopt the quick procedure of summary jurisdiction where the damage caused did not amount to more than £5. This amount was adequate before the war, but the cost had increased so much that in a number of accidents since that time the damage was above £5; in this case the summary procedure did

not apply, and the Corporation had to take the matter to the County Court.

Mr. *Clegg*, replying to the Chairman, said that the Corporation merely asked to be placed in the same position as before the war.

Further consideration of the clause was postponed, in order that Sir Ernest Holderness, of the Home Office, might attend. Accordingly, Sir Ernest attended on Thursday, June 25, and said the principle was that a man could not be liable for damage for which he was not responsible under the common law, and he should not be so liable under a Special Act. He pointed out that the Gas-Works (Clauses) Act was passed nearly 80 years ago, and circumstances had changed considerably since then. Commercial traffic was much greater, and he did not consider this provision should be extended further.

The Chairman said that the Corporation were asking the Committee practically to modify the common law.

Mr. Fitzgerald replied that it had already been modified by section 20 of the Gas-Works (Clauses) Act, which had worked satisfactorily until 1914; and the Corporation did not ask that the principle should be altered.

Sir Ernest Holderness said that the word to which objection was taken was the word "accidentally."

The Chairman announced that the Committee took the view of the Home Office.

Mr. Fitzgerald said it might help the Corporation if the figure of £5 were increased to £10 in the case of damage caused through negligence.

The Chairman asked Mr. Fitzgerald to submit a clause to Sir Ernest Holderness for approval.

LEGAL INTELLIGENCE.

River Pollution.

At the Melton Petty Sessions last week the Melton Mowbray Gas Light and Coke Company, Ltd., were summoned for knowingly polluting the River Eye at Melton, in March. A representative of the Trent Fishery Board, who brought the proceedings, explained that the Eye came under the Board's control, as it was a direct tributary of the Trent through the Wreake and the Soar. The Board complained that the refuse from the Company's works entering the River Eye was fatal to the freshwater fish in the river. Mr. Thos. McDougall, Manager of the Gas Company, said he had been under the impression that the outfall entered Scalford Brook, and had accordingly taken a sample of that water, which proved clear. Mr. S. H. Garner, Vice-Chairman of the Company, called by the Bench to give evidence, said the Company were not aware of the existence of the outfall scheme, though he admitted that it could only have been planned to empty into the river many years ago. He felt aggrieved that the prosecutors had not communicated with the Company before taking proceedings, as they would have abated the pollution, had it been brought to their notice. The Bench stated that they considered there had been gross negligence on the part of the Company. It had not been proved, however, that the defendant Company knew they were polluting the river, and on that account the case would be dismissed.

Claim for Personal Injuries.

On the 29th ult. the action of *Evans v. Sutton Gas Company* came before Mr. Justice Avory and a Special Jury; the plaintiff seeking to recover damages for personal injuries sustained through the alleged negligence of defendants' servants. The defendants had opened or excavated a portion of the roadway in Waterloo Road for the purpose of laying gas pipes; and it was alleged that they negligently failed to replace the excavated road in a proper and safe manner, and to restore the roadway, so that plaintiff, when riding his bicycle along the road on Oct. 5, 1923, collided with loose earth, causing him to be thrown and to dislocate his shoulder. Defendants denied the alleged negligence, and said the accident was caused by the contributory negligence of plaintiff in not slowing-down when approaching the portion of road referred to, and in riding over the portion of the road without keeping any proper control over his cycle. Evidence having been given on behalf of plaintiff, the hearing was adjourned; and on the 30th it was stated that the parties had come to terms, and that the action had been settled on terms endorsed on Counsel's briefs.

Bahia Blanca Gas Company, Ltd.—A total debit balance of £64,835 is shown in the accounts to Dec. 31 last, which will be submitted at the annual meeting to-morrow, July 2. Compared with the previous year, the quantity of gas sold in the period under review shows an increase of 4·9 p.ct., though, owing to reduced charges, the receipts from this source are less by 1·04 p.ct. Aided by cheaper fuel, the management have been successful in reducing production costs; and recent advices are to the effect that public interest in gas cookers, &c., brought about by the reduced tariffs, is maintained.

Railway Centenary.—Mr. Punch's contribution to the celebration of the Railway Centenary takes the form of a Special Supplement to the issue of July 1, giving a full account of his activities as a railway historian, critic, prophet, and humorous commentator from 1841 down to the present day. The text is profusely enriched with reproductions of cartoons and "cuts" which serve to illustrate the progress in construction of "coaches" and engines as well as the manners and morals of passengers. Finally, the chronicle is concluded with a choice assortment of famous railway jokes and anecdotes, illustrated by the pencils of well-known artists. Mr. Raven-Hill contributes a special double-page cartoon, in which the triumph of steam, speed, and railroad construction are vividly illustrated.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following notices have appeared in the "London Gazette" regarding applications to the Board of Trade under the Act.

SPECIAL ORDERS.

Portsea Island Gas Company.

To enable the Company to acquire the undertaking of the Havant Gas Company, to further extend the limits of supply, to raise additional capital, to hold annual meetings, to supply power gas, to make regulations regarding the supply of gas, to establish profit-sharing, and for other purposes.

Tamworth Gas Light and Coke Company.

To authorize the Company to purchase the undertaking of the Fazeley Gas Company, Ltd., to use scheduled land for gas purposes, to raise additional capital, &c.

DECLARATIONS OF CALORIFIC POWER.

Settle Gas Company, Ltd.—500 B.Th.U., in substitution for 530 B.Th.U. (Oct. 1.)

Whitwell and District Gas Company.—475 B.Th.U., in substitution for 500 B.Th.U. (Sept. 30.)

OLDHAM GAS DEPARTMENT.

Results of Year's Working.

In his annual statement of accounts for the year ended March 25, Mr. Ernest Parry, the Commercial Superintendent, states that the net loss on the year's working amounted to £6038, which, with the debit balance brought from the previous year, and the amount contributed to the borough fund, leaves a debit balance to be carried forward of £38,304.

Receipts for tar and ammoniacal liquor show a decrease. The net price realized per 1000 c.ft. of gas sold during the past year was 3s. 2·18d., as compared with 3s. 5·88d. in the year previous. The quantity of gas consumed by public lamps was 137,625,000 c.ft. Compared with last year this shows a decrease of 4,879,000 c.ft. The quantity of gas manufactured at the different stations was: Oldham 233,537,000 c.ft., Higginshaw 480,836,000 c.ft., Hollinwood 876,931,000 c.ft. of coal gas and 32,043,000 c.ft. of water gas—a total of 1,623,347,000 c.ft., against 1,617,447,000 c.ft. in the preceding year, being an increase of 5,900,000 c.ft. The amount of coal used in its production was 93,698 tons. The quantity of gas unaccounted for was 148,537,000 c.ft., which represents 9·15 p.ct. of the amount made. The total number of meters fixed on March 25 was 57,909, which is an increase of 759 as compared with last year. The number of prepayment meters in use has increased during the year from 16,252 to 20,162, and the quantity of gas consumed through this type of meter has increased from 237,104,900 c.ft. to 309,836,100 c.ft.

During the past twelve months a supply of gas has been given to about 700 houses not previously supplied and in connection with which the owners were not willing to go to any expense at all. The amount of gas consumed has been surprisingly large considering the size of house. The actual number of consumers on March 25 last was 53,734, or 719 more than on March 25, 1924.

The total number of cooking stoves and grillers in use on March 25 was 27,926 (excluding stoves owned by consumers), an increase of 882 during the year. The net increase in the number of gas fires, &c., fixed during the year is 292. The total number in use on March 25 last was 6290, excluding those owned by consumers.

Luton Gas Company Up-to-Date.

The Luton Gas Company have issued a prompt and definite challenge to the claim of the Corporation Electricity Committee that electricity is cheaper than gas for heating purposes. They have prepared a circular setting out in the briefest and plainest terms the facts relating to the two sources of energy. The circular is bound to receive the careful attention of tradesmen and housewives, especially as there is being launched by the Luton Corporation a strong campaign to induce people to instal electricity. This campaign is being carried on over a radius of 15 miles from Luton in the greatly extended area which the Authority can supply under the powers recently obtained by them, and is designed to appeal to a population of approximately 100,000. The Gas Company's circular is in the following terms:

The undermentioned fact will be of great interest and should be known by all gas consumers.

1 therm of gas, costing 7d., contains 100,000 heat units.
1 unit of electricity, costing ½d., contains 3440 heat units.
14 @ ½d. = 7d. Therefore multiply 3400 by 14 and you get 48,160 heat units from electricity for 7d., against 100,000 from gas for 7d. This is more than 2 to 1 in favour of gas.

Results at Sidmouth.—Presenting the year's gas and electricity accounts to the Sidmouth Urban Council, the Chairman of the Committee, Mr. J. G. H. Halse, said there was a profit on the gas account of £623, after paying £2379 interest and £1976 repayment of loans, but a sum of perhaps £200 would have to be contributed in income-tax. He said it seemed ridiculous for them to make a profit on the lighting of the town, and have to pay income-tax on it out of the ratepayers' pockets. The works were now capable of producing 40 million c.ft. of gas per annum, instead of only 22 million when they were first acquired; and for the purpose of extensions and re-maining of the town £5095 had been borrowed, upon which charges had to be paid out of the profits.

PLYMOUTH AND STONEHOUSE GAS LIGHT AND COKE COMPANY.

New Issue of Stock Approved.

The Annual General Meeting of the Plymouth and Stonehouse Gas Light and Coke Company was held on June 23—Mr. J. H. ELLIS presiding. The meeting was followed by an extraordinary meeting of the proprietors.

The SECRETARY (Mr. G. H. Bolton) read the notice convening the meeting, and the minutes of the last meeting.

The report stated: The balance standing to the credit of the profit and loss account amounts to £34,234, and the Directors recommend the payment therefrom, on July 1, of a dividend for the half-year to March 31 last, at the rate of £7 17s. 6d. p.ct. per annum on the ordinary stocks; 13s. 3d. per share on the additional shares; and 12s. 9d. per share on the new shares, less income-tax. This will absorb £13,957, leaving £20,276 to be carried to the credit of the next account. Gas sold during the year shows an increase of 35,546,000 c.ft., or 2·3 p.ct., over the previous year. To cope with the increased demand for gas, and to improve the efficiency of the manufacturing plant, alterations and improvements are being effected at the gas-works, which will necessitate further expenditure, to meet which the shareholders are asked to sanction the raising of additional capital. To mark the appreciation of the services rendered by the employees, the Directors decided to re-introduce the co-partnership scheme, and to widen the scope of the superannuation fund, as from Oct. 1, 1924. They have every confidence that the step they have taken will inure to the permanent benefit of the gas consumers, employees, and shareholders.

Mr. J. H. ELLIS (Chairman), in moving the adoption of the annual report and accounts, pointed out that on the debit side they would have a total of £7926, with credits of £6816, leaving a net debit for the year of £1110 only. Their total expenditure on capital account amounted to £455,550, equivalent to £288 per million c.ft. of gas sold—a particularly low and satisfactory figure. The total debts amounted to £237,876, a decrease of £5138. The principal items of expenditure were: Coal and oil, £137,473 (an increase of £11,242); carbonizing wages, £14,619 (a decrease of £1356); works repairs, £23,585; mains, £17,239; general establishment charges, &c., £4551; superannuation fund, £4782; and co-partnership fund, £3449. On the credits and revenue account the total credits were £273,080 (a decrease of £6828). After paying income-tax, providing for dividends and debenture interest, and carrying £778 to redemption fund account, there remained a credit balance to be carried forward (subject to payment of half-year's dividend on July 1) of £34,234, compared with £41,627 the previous year. In connection with the showroom profits their output of appliances had practically doubled during the last three years. Their old retort house had become out of date in principle, and was wasting money. They had accordingly, on the advice of their Engineer, backed up by that of Mr. Doig Gibb, erected vertical retorts. From the working of these Mr. Hoyte, their Engineer, estimated a saving of £15,000 per annum. They had also installed additional carburetted water gas plant; and the savings which had already resulted from its use were gratifying. Those works would necessitate the raising of further capital; but, thanks to the careful handling of their capital account, and to the saving their Engineer predicted, he saw no reason why it should limit their dividends or their staff's share of profits, and, what was of far greater importance, involve an increase in the price of gas. If the price of gas had to be increased later on, it would be due to a greater drop in the price of residuals, or to other causes he could not at the moment foresee. In working for a smokeless town, and in endeavouring to bring into harmony the interests of consumers, staff, and shareholders, they had built up a sound, successful, and beneficial undertaking. With a continuance of the co-operation of last year the future was bright for all. He spoke of the help he had at all times received from his colleagues, from Mr. Hoyte, Mr. Bolton, and all in the Company's service.

Mr. T. G. GREEK WILLS (Deputy-Chairman) seconded, and the report was adopted.

An EMPLOYEE of the Company spoke appreciatively of the superannuation and co-partnership schemes, remarking that the men were putting their backs into the work, to show their appreciation of the Directors' action.

Messrs. F. F. W. Housker, M.B.E., and R. B. Johns, and Colonel R. W. Norrington, C.M.G., were re-elected Directors; and Mr. B. Rutland was re-elected Auditor.

EXTRAORDINARY MEETING.

At the extraordinary meeting which followed it was agreed: That in pursuance of the powers contained in the Plymouth and Stonehouse Gas Act, 1903, the capital of the Company be increased by the issue of ordinary stock not exceeding (with premiums) £75,330; that the said ordinary stock be issued at the discretion of the Directors, and offered for public sale as directed by the said Act, and shall form part of the existing ordinary stock in the capital of the Company, and be entitled to a standard dividend of 5 p.ct., subject to the variation in accordance with the sliding-scale as provided in the Plymouth and Stonehouse Gas (Charges) Order, 1921.

Year's Working at Pontypridd.—Mr. D. Muir (the Engineer and Manager), reporting on the working of the Pontypridd Urban District Council Gas Department for the year ended March 31 last, says that during the year 199 consumers were added, 241 additional cookers and 141 additional fires put in use, and much main and service work was carried out. Gas sales increased 5,648,185 c.ft., and unaccounted-for gas was reduced 3,996,985 c.ft., bringing this figure to the lowest point for sixteen years. The gross profit amounted to £10,364, and the net profit to £4149. Rates have been assisted to the extent of £1000 from the Gas Department.

PRIMITIVA GAS COMPANY OF BUENOS AIRES, LTD.

The report which was adopted at the meeting of the Corporation on Tuesday, June 16, at River Plate House, stated that the balance of revenue account for the year ended Dec. 31 last, and the interest received from the Cia Hispano-Americana de Electricidad, amounted to £118,202; sundry small receipts from other sources bringing the total to £118,524. Debenture interest and other charges reduced this to £39,377. The Directors went on to say: The Board are pleased to report substantial improvement in the Company's business. Under the new management strenuous efforts have been made towards putting the Company's works in the highest state of efficiency, and this will be continued during 1925. In consequence, the technical results achieved in the year under review as compared with 1923 show a considerable improvement, which is reflected in the accounts. The Board report, with deep regret, the death of their esteemed colleague, Mr. Harry Edward Jones (Past-President of the Institution of Civil Engineers), whose great technical ability was of the highest value to the Company over a period of 25 years. The Board also regret to report the death of Señor Don Samuel Hale Pearson, who, since 1901, had used his great influence in the Company's interest, as Chairman of the Local Committee in Buenos Aires. Señor Don Miguel Pineiro Sorondo has been appointed Chairman of the Local Committee. Mr. Campbell P. Ogilvie has been elected Chairman of the Board of Directors. To fill the vacancy on the Board occasioned by the death of Mr. H. E. Jones, the Directors propose the election of Mr. Frank Harding Jones, M.Inst.C.E., whose great experience in the administration of gas undertakings would add strength to the Board. The Board are further desirous of appointing an additional Director, but have no power to do so, and are therefore proposing an amendment to the Articles of Association giving them the necessary power. The Municipality of Buenos Aires have still failed to take steps to arrive at an agreement for the fixing of the capital of the Company, in accordance with clause 5 of our contract with them.

Mr. C. P. Ogilvie presided at the meeting, and said that the City of Buenos Aires was estimated to contain 2,000,000 inhabitants, living in 400,000 houses and tenements, and there were thousands and thousands of persons who were still boiling their water over a brazier by slowly fanning charcoal. The Company were engaged in propaganda to convince the housewife that time was saved and work made easier by means of gas ovens and rings; and they meant to succeed. If the Company supplied gas rings to each family, and they used but one-halfpenny worth of gas in the morning for making their tea or coffee, it would mean a revenue of £300,000 per annum. The Company's receipts from all sources amounted during the year to £700,187, an increase of £94,967 over the previous year. There had been an increase in every item on the credit side, and distinct progress was being made. They had added 1765 new consumers to their number; and on an average each consumer had taken a slightly increased amount of gas. He asked the shareholders to have patience a little longer. If they could maintain the present rate of progress, he saw no reason why the Company should not, in the near future, again take their place in the dividend-paying list.

The report and accounts were adopted, and a resolution was passed for the amendment of the Articles of Association so as to permit of there being a maximum of seven Directors, instead of five as at present.

PATENT OFFICE REPORT.

The report for the year 1924 of the Comptroller-General of Patents, Designs, and Trade Marks states that the total number of applications for patents received during the year was 31,370, which was a decrease of 1251 when compared with the number for the previous year. The complete specifications filed totalled 18,800, which was 92 more than in 1923. The applications made by way of communication from abroad, at 1455, were 107 more than in the year before.

Under the provisions of the International Convention for the Protection of Industrial Property, 4517 applications were made in this country, as compared with 3683 in 1923. There were 310 applications post-dated in consequence of disconformity between the complete and provisional specifications; and there were 793 applications for patents of addition. There were 576 cases in which one complete specification was filed in respect of two or more cognate provisional specifications. Opposition to the grant of a patent was entered in 183 instances, and there were 17 appeals to the Law Officer from decisions of the Comptroller. Applications were made in 79 cases for the restoration of patents which had lapsed in consequence of the non-payment of renewal fees; and the majority were restored. Under the provisions empowering the Comptroller to revoke a patent upon application made within two years from the date of the patent, by any person who would have been entitled to oppose its grant, there were 22 applications covering 21 patents. More than one-half of the cases were still pending at the end of the year; but five orders had been made requiring amendment of the specification (following agreement between the parties), while one patent was revoked (with the consent of the patentee), and one application was dismissed. There were also other applications made prior to the sealing of the patents. One offer to surrender a patent was received; and a revoking order was made. An extension of term for three years was granted in the case of one patent; and there are now in force 107 patents which have been prolonged beyond the normal period.

Spilsby Gas Company.—In their annual report, the Directors of the Company state that an outstanding loan has been discharged; and they recommend a dividend of 5 p.ct., free of income-tax. This is the first dividend paid for some years.

NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

The uncertainty with regard to the labour situation in the mines, with the possibility of a stoppage at the conclusion of the present agreement, has, as usual, induced some extra inquiry, especially for the better qualities, which has made the market rather more interesting than it might otherwise have been in the race holiday week. There has not been a great deal of additional business put through; the inquiries being more in the nature of feelers. But they have given a slight, and much needed, stiffening to the market, and have, in some cases, encouraged collieries to advance their quotations slightly for forward business. Fitters who are fairly well placed with contract business in some cases decline to quote, indicating a hope that there may be some rush for coals next month. Stocks, however, are everywhere so high, and the potential increase of supplies so considerable if collieries work full time, that any sustained rise in price seems improbable.

Wear Special gas makes still quote a nominal 18s. 9d. f.o.b., and best qualities 18s., and they are steadier than they have been in recent weeks. Second-class gas is 15s. 6d. to 16s. 6d., and still plentiful at these prices. Coking unscreened is in very poor demand, and obtainable down to 15s. 3d. Durham bunkers are rather firmer, and best qualities have advanced the quotation to 17s.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

The more tense position in the coalfields has not flurried the market except in a minor degree. Consumers of slack betray more anxiety to safeguard themselves against contingencies. The quickening of demand has braced up prices to the extent of 9d. or more, as it is evident there are no very abundant reserves to draw upon. D.S. nuts and beans have also been in somewhat better request, and values have stiffened.

Apart from these movements, the market for industrial fuel has not been appreciably stirred out of its lethargy. The facility with which orders have been responded to has had the effect of allaying uneasiness. So far as the heavy industries are concerned, the attitude to the long-drawn-out discussions between coalowners and miners is one of indifference, or affected indifference. Trade is so bad and profits are so problematical that ironmasters say a rest would not be a bad thing, perhaps. The further encroachments which foreign competition is making cannot be a matter of unconcern, however. It is evident the equanimity which prevails is due largely to the confidence which users of coal and coke have in the continuance of supplies. The view is widely expressed that if there is a rupture it will be short-lived and partial in its extent.

Offerings of blast-furnace coke have not been affected. There are still bargains to be picked up. Midland smelters have concluded an agreement with the cokeries for a reduction of the basis from 15s. 9d. to 13s.; the position to be reviewed at the end of July. House coal is in rather better request. The Haunchwood Colliery, Stockinford, one of the oldest mining enterprises in the Warwickshire coalfield, is to be closed, and the employees, numbering about 400, are seeking employment at other pits in the Nuneaton district.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

There is an undecided opinion owing to the decision of the coalowners to give the necessary one month's notice to the miners to terminate agreements on July 31, and on the face of it it would seem that this would occasion greater activity in business, but so far the situation has been viewed with a calm attitude on the part of buyers. House coals are not in urgent demand, owing to the climatic conditions; but there is a little activity on the part of those who have to buy from week to week. Prices are unaltered in this direction.

Industrially, there is an inclination on the part of some of the larger consumers to put into stock the qualities they have been in the habit of taking, but not any increased quantities.

Gas coals move slowly under contract, with indication of buyers being anxious in regard to their forward supplies. The present situation has undoubtedly brought about a stabilization of figures throughout the rest of the contracting period.

There is no apparent change in the export demand, and the general situation may be summed up as one of extreme difficulty. Superficially it appears that there will be a stoppage, but for how long is a question.

Bunker and export prices at Hull at the week-end (f.o.b. usual shipping ports) were: South Yorks.—Hards, 19s. 3d. to 19s. 6d.; screened gas coal, 16s. 6d. to 17s. 6d.; washed trebles, 17s. to 17s. 6d.; washed doubles, 16s. to 16s. 6d.; washed singles, 14s. 9d. to 15s. 3d.; washed smalls, 11s. to 11s. 3d.; unwashed doubles, 15s.; rough slack, 9s. 10½d. to 10s. 1½d.; smithy peas, 16s. 6d. to 18s. 6d. West Yorks.—Hartleys, 16s. to 17s.; screened gas coal, 16s.; washed trebles, 17s.; washed doubles, 15s.; washed singles, 14s.; washed smalls, 11s.; unwashed trebles, 17s.; unwashed doubles, 13s.; rough slack, 9s. 6d. coking smalls, 9s. to 10s. per ton. Derbyshire and Notts.—Top hards, 19s. 3d. to 20s.; washed trebles, 17s. to 17s. 6d.; washed doubles, 15s.; washed singles, 14s.; washed smalls, 10s. to 10s. 3d.; unwashed doubles, 13s. 6d. to 14s. 6d.; rough slack, 9s. 6d. to 9s. 9d. Yorks, Derbys, and Notts.—Screened steam coal, 15s. to 16s.; gas coke, 19s. to 20s.; furnace coke, 17s. 6d.

In Lancashire there is a fair demand for ordinary industrial coal and also for the highest quality of Lancashire slacks. The lower qualities are not selling well, owing to outside slacks coming in. Lancashire pit prices are from 10s. to 16s.

GAS EXHIBITION AT DOVERCOURT.

On Monday, June 22, an exhibition organized by the Harwich Gas and Coke Company was officially opened in the Alexandra Hall, Dovercourt.

Mr. W. J. W. Jervis (Chairman of the Company), who presided at the opening ceremony, remarked that it was some years since they had an exhibition of that kind in Harwich. This was their third exhibition; and whenever they had a show of that nature, it enabled consumers to see the advances which were made from time to time in the means of using gas. The industry had of recent years made considerable progress, especially during the period since the war.

Mrs. W. C. D. Hepworth, opening the exhibition, said she had no doubt that most of those present were more interested in the domestic uses of gas, but they must not lose sight of its services in industry. Industry depended on light, heat, and power. Waste meant loss of wealth; and gas eliminated waste by the various by-products extracted during its manufacture. A tour of the exhibition must convey to them the hundred-and-one ways in which gas could be practically used.

Mrs. Hepworth was handed a beautiful bouquet by Mr. Gregory, the Secretary of the Company. Miss Marguerite Fedden gave demonstrations of cookery each afternoon and evening during the week; the cookers used being the Radiation "New World" and the Fletcher "Kingsway." A representative range of Fletcher gas appliances was shown, presenting the case for gas as a general-purpose fuel in a powerful way. Altogether the exhibition was highly successful and reflected great credit on the organizers.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *June* 29.

Interest in pitch for next season's shipment is not yet very pronounced, and the price continues more or less nominal at 41s. to 42s. per ton in bulk at makers' works.

The market for road tar is, however, extremely active; the continuous spell of fine weather causing very heavy demands to be made upon producers. It looks as if record deliveries will be made this season.

Creosote maintains a firm tone at about 7d. per gallon net in bulk at makers' works. It is interesting to note that exports up to the end of May this year amount to 16,162,000 gallons.

Solvent naphtha is firm at about 1s. 8d. per gallon for 95/160 quality.

Pure benzole and pure toluole are steady at 1s. 11d. to 2s.

Tar Products in the Provinces.

June 29.

The markets for tar products have remained about the same throughout the past week.

In regard to pitch, the Continental consumers have been trying to purchase, but have found quotations to be higher than when they last inquired a few weeks ago. Consequently, for the moment, they have refrained from purchasing. The market certainly seems steadier than was the case a few weeks ago.

Creosote is steady, although no business of importance is reported.

Benzole and solvent naphtha are in fair demand.

Crude carbolic is still neglected.

The average values for gas-works products during last week were: Gas-works coal-tar, 26s. to 31s. Pitch, East Coast, 39s. to 40s. f.o.b. West Coast—Manchester, 34s. to 35s.; Liverpool, 35s. to 36s.; Clyde, 38s. to 39s.; Benzole, 90 p.ct., North, 1s. 7¼d. to 1s. 8½d.; crude, 65 p.ct., at 120° C., 1s. to 1s. 1d., naked at makers' works; 50-90 p.ct., naked, North, 1s. 7½d. to 1s. 8½d. Toluole, naked, North, 1s. 6½d. to 1s. 7½d. nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8½d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 1s. to 1s. 2d. Creosote, in bulk, North, liquid, 5⅝d. to 6d.; salty, 5⅝d. to 5⅞d.; Scotland, 5½d. to 5⅝d. Heavy oils, in bulk, North, 6½d. to 7d. Carbolic acid, 1s. 5d. to 1s. 6d. prompt. Naphthalene, £11 to £14; salts, £4 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality unsaleable.

TRADE NOTES.

Repeat Order for Guy Motors.

The Gas Light and Coke Company have expressed general satisfaction with their Guy vehicles by sending a further repeat order for four 30-cwt. chassis. This will bring their fleet of this type up to fifteen.

CONTRACTS OPEN.

Dehydrated Tar.

The Tipton Urban District Council are inviting tenders for the purchase of their surplus dehydrated tar. [See advert. on p. 60.]

Overhead Runway and Recording Weighing Machine.

Tenders are invited by the Tipton Urban District Council for the supply and erection of a 10-cwt. hand overhead runway to be fitted with an overhead recording weighing machine. [See advert. on p. 60.]

Despite the fact that last year the Chorley Council sold 4 million c.ft. more of gas than in the preceding year, the trading profit shows a drop from £13,751 to £8907. In June, 1924, the Council reduced their charges to consumers by 6d. per 1000 c.ft., and to this is attributed the abnormal drop in profits.

Coventry Gas Department.

The gas undertaking accounts for the past year show a surplus of £1365, which it is proposed to carry forward. The previous year the surplus was £51,310, and an allocation from it of £10,000 was made in aid of the rates. The reduced surplus is attributed by the Gas Committee to great difficulties caused by the national industrial situation, and the changes in the Continental residuals market. The gas made was a record for the undertaking, being 2173 million c.ft., compared with 1935 millions in the previous year. The gas sold was 2007 millions, and that used for industrial purposes showed an increase of 19 p.ct. The number of consumers increased from 35,793 to 36,738, of whom 26,037 are prepayment consumers. There are 31,204 cookers out on hire, and 3409 fires. The receipts from the sale of gas show a decrease of £1198 as compared with 1923-24, but the average price for 1924-25 was 2s. 7d. per 1000 c.ft., against 2s. 11d. in 1923-24. The decrease in charges was almost counterbalanced by the additonal revenue from the larger quantity sold. In a summary of the revenue and net revenue accounts for the years 1923-24, it is stated that the working expenses were £368,689 compared with £324,683. Capital expenditure defrayed from revenue was £15,497, against £35,172 in 1923-24. The amount brought forward in the 1924-25 account was £310, and in the previous year £48,020. The report also states that a matter which should be mentioned is the increase in the value of the stocks required for the efficient working of the undertaking. Mainly as a result of discussions with the local manufacturers, the value of the reserve stock of coal and coal equivalents has been raised by £16,284. The value of gas fires on hire has been increased by £5300, and the total value of stock and stores on hand at the end of the year was £85,939.

Gas Output at Stoke-on-Trent.—The accounts of the Gas Department of the County Borough of Stoke-on-Trent for the year ended March 31 have appended to them a working statement signed by the Chief Engineer and Manager (Mr. Alexander Mackay). This shows that the total quantity of gas made was 1,394,479,600 c.ft., or 6,554,054 therms. The quantity sold was 3·65 p.ct. more than in the previous year. The make of gas per ton of coal was 13,186 c.ft. The gross profit on revenue account transferred to profit and loss account was £51,116, and the loss transferred to net revenue account £3635.

Leighton Buzzard Price Increase.—The Leighton Buzzard Gas Company have decided to increase the price of gas by 1d. per therm, from 11½d. to 12½d. The necessity for this step is stated to be the serious falling-off in the value of residuals. Prior to the war the price of gas in Leighton Buzzard was 2s. 10d. per 1000 c.ft., and it was not raised until 1917, when it became 5s. 2d. In March, 1923, there was a reduction of ½d. per therm, and in December of that year a further drop of 1d. per therm. A subsequent decrease of ½d. last year brought the price down to the equivalent of 4s. 5½d. per 1000 c.ft.

Accrington and District Gas Board.—Officials of the Board were favoured with ideal weather for their annual picnic on June 24. Starting from Accrington at 6 a.m., a party of 34 journeyed by train to Penrith. At noon they started by motor for Pooley Bridge, and the next stage of the outing was a nine miles sail, by steamer, on Ullswater, to Patterdale. Thence the journey was continued by motor to Penrith, a halt of half-an-hour being made at Aira Force, to view the falls. An interesting event was the presentation of a silver-mounted walking stick and wallet to Mr. J. E. Smith, in recognition of his services as picnic organizer for several years. The presentation was made by Mr. R. T. Holgate, the oldest official present, who has a record of over 50 years.

Stourbridge Gas Department.—In his annual report for the year ended March 31, Mr. C. H. Webb, M.Sc., Engineer and Manager to the Stourbridge Gas Department, states that the sales of gas show an increase of about 7,500,000 c.ft., notwithstanding the mild weather in the winter quarters. The gas unaccounted for is practically the same as last year. Considerable reduction in the price of gas was given from Jan. 1, 1924, and the effect is equivalent to a difference of about £3000 on the year's revenue. In addition, the prices obtained for residuals depreciated considerably during the year. Last year they realized a record figure for residuals of nearly 81 p.ct. on the cost of coal, while this year they have only been able to obtain slightly over 71 p.ct. The balance on revenue account to go to profit and loss account is £21,750. The balance from revenue account is subject to the usual deductions for income-tax, annual instalments, expenditure on mains, services, &c., and there remains a surplus for the year of £3848, which is rather better than the average, and represents about 3d. per 1000 c.ft. sold.

Municipalization at Rowley Regis.—A proposal for municipalizing the gas undertakings in Rowley Regis is to be submitted to the members of the Urban Council by Mr. J. B. Holden, who intimated at a meeting of the Council recently that it was his intention to move at the next meeting that a special Sub-Committee should be appointed to consider a scheme for taking over the gas-works in the district. The matter arose during a discussion with regard to the tenders for street lighting during next winter. The price quoted by the Cradley Heath Gas Company for lighting the whole of the small lamps in the lower wards until midnight in September and April, and throughout the night from October till March, was £3 17s. 6d. per lamp. The tender of the Blackheath Gas Company for the Rowley and Blackheath Wards was £3 19s. 6d. per lamp. Mr. Read inquired why there should be a difference of 2s. per lamp in the tenders, and moved that the matter should be referred back, and the Electric Light Company be asked to tender. The Chairman, however, pointed out that, unless the contracts were entered into immediately the streets would not be lighted during September, as the Council would not meet in August. No alteration, he said, could be effected for next winter, but the whole subject could be discussed in connection with Mr. Holden's motion. Mr. Read then withdrew his resolution.

European Gas Company, Ltd.

At the annual meeting next Tuesday (July 7) the Directors will report that, although the value of the franc has remained low during the Company's financial year, 1924-25, and has, indeed, shown further depreciation, the fluctuations have been considerably less violent than in previous years, and the effect on the Company's results has been proportionately less serious. The operations of the year have resulted in a profit of £74,028, which is sufficient to allow of the payment of a dividend of 5 p.ct., free of tax. An interim dividend of 4s. per share was paid on Jan. 31, 1925; and the Directors now recommend that a final dividend be declared of 6s. per share—making a total of 10s., or 5 p.ct., for the year, free of income-tax. As indicated on previous occasions, the Directors anticipate that, so long as the course of the French exchange remains unstable, considerable fluctuations in the amount of the Company's profits in sterling are inevitable. They consider it prudent, therefore, to build up, as and when opportunity offers, a reserve which can be drawn upon for the purpose, *inter alia*, of supplementing the profit earned in lean years. With this object in view, they recommend that the balance available, after payment of the final dividend proposed, be carried to general revenue. The consumption of gas shows an increase of 5·58 p.ct. over the previous year, and the number of consumers has risen from 133,887 to 139,121, an increase of 5234, or at the rate of 3·90 p.ct. A final settlement with regard to the price of gas has been reached with the Municipalities of Havre and Nantes, and at the same time the contracts with these towns have been prolonged. The Havre contract now expires in 1970, and the Nantes contract in 1978; the latter conditionally upon the transfer withn ten years of gas manufacturing operations to the new site outside the town acquired before the war. The works and plant at the stations have been maintained in a state of efficiency, and work has continued on the examination and repair of the mains. The new retort house at Rouen has been completed and put into action. The Directors record with very deep regret the death, on March 24 last, of Mr. H. E. Jones, M.Inst.C.E., J.P., who had been connected with the Company since 1897, and had been Chairman since 1914. Dr. Charles Carpenter, C.B.E., has been elected Chairman, and Mr. F. H. Jones, M.Inst.C.S., Deputy Chairman. The vacancy caused by the death of Mr. H. E. Jones has been filled by the election as a Director of Mr. A. M. Paddon, M.Inst.C.E., subject to confirmation by the shareholders at the annual meeting.

Price of Gas Reduced at Pittenweem.—At the annual meeting of shareholders in the Pittenweem Gas Company, the recommendation of the Directors was agreed to, that a dividend of 5 p.ct., free of income-tax, be declared, and that the price of gas be reduced 5d. per 1000 c.ft.

Welwyn and Hatfield Gas Capital.—Messrs. A. & W. Richards, of No. 37, Walbrook, E.C., are offering for sale by tender, on behalf of the Directors, 2400 £5 additional ordinary shares in the Welwyn and Hatfield Gas Company, Ltd. The shares will rank equally with the existing similar shares now receiving the standard dividend of 7 p.ct. per annum. The Welwyn, Knebworth, and District Gas Company, Ltd., and the Hatfield Gas Company, Ltd., were amalgamated as from April 1 last.

Issue of Debentures at Wellington.—An extraordinary meeting of the Wellington (Salop) Gas Company was held on June 23 to consider the issue of £10,500 5 p.ct. perpetual debentures to provide for additions and extensions rendered necessary by the Company's increasing business. The Chairman, Mr. C. W. Leake, said that in the report of the Directors for the year ended Dec. 31, 1924, the Board referred to the increasing demand for gas, and intimated that they had concluded arrangements whereby new plant would be installed for the winter of the present year. The most pressing need was the provision of additional storage; the total holder capacity being but 60 p.ct. of the maximum daily output in winter. The total cost of the work mentioned would be about £14,000. With £4642 unexpended capital at the end of 1924, and £10,500, for which the sanction was now asked, the Directors proposed to meet this expenditure. The Company would still be short of working capital, but as the present issue would exhaust their existing borrowing powers, the Directors thought it would be prudent to defer the issue of further ordinary stock until the positon better justified the hope of a substantial premium on this class of capital. The Chairman then proposed the appropriate resolution, which was seconded, and carried unanimously.

Burnley Gas-Works.—The Burnley Corporation Gas Engineer (Mr. J. Herbert Clegg) and the Borough Surveyor (Mr. A. Reece) have presented a report on the new gas-works to be erected at Old Hall. The estimated cost is £300,500. In deciding to submit estimates amounting to the above sum, the compilers of the report state they were influenced by the fact that application was being made for assistance from the Unemployment Grants Committee, and at the recent inquiry the Inspector made it clear that, if a grant were made, in calculating the grant a sum of £79,000 (being the estimated cost of the alternative scheme for work necessary to enable the present gas-works to carry on for a period of about five years) would not rank for award. The buildings have all been designed sufficiently large to accommodate increases in plant capacity to a total production of 8 million c.ft. per day—with the exception of the retort house and coal store—and the Gas Engineer has carefully considered the question of limiting the initial expenditure upon the plant, having regard to the possibilities of a bulk supply of gas from outside sources and alternative supplies of illuminants and heat; but any advantage which might be gained by reducing further the initial capital cost would be lost by increased working costs, and is not recommended. Providing a satisfactory reply is received as to a grant, it is recommended that, as soon as the sanction of the Ministry is obtained, tenders be invited and the work put in hand.

STOCK MARKET REPORT.

THE uncertainty and depression of the previous week continued on the Stock Exchange last week. Considerable anxiety was in evidence with regard to the account, which, coinciding with the close of the half-year, was affected by the restrictions in the carry-over facilities; but, apart from a material set-back in prices, nothing of serious effect was reported. Gilt-edged stocks are still suffering from the effects of new issues; and although the Conversion scheme and several Colonial issues have been postponed, it seems evident that an even lower range of prices may be expected. Of the £6,000,000 of new issues last week, only about £2,300,000 were subscribed, and the underwriters have large commitments to unload.

The news from China was a little better at the end of the week; but the position is still grave, and, together with news from Greece, is playing an important part in affecting the general financial outlook. Foreign issues were in consequence very weak, and the Banks with Chinese connections also suffered. Home Rails did not maintain the previous week's recovery, doubtless due to the conferences taking place with regard to reduced traffic returns and the proposed cut in salaries and wages.

It will be seen by the Table that the Gas Market was no exception to the general rule. There were no appreciations during the week, and, after excluding *ex* div. quotations, no less than nine quotations were marked down. It is true that with the exception of the two Continental companies the depreciation is not heavy, but occurring as it does in the principal London and Suburban group it indicates what may be expected in the case of the Provincial group. It is reported that jobbers in gas stocks are in the exceptional position of being unable to place the stocks at a profit.

The following transactions were recorded during the week:

On Monday, Brentford "A" 96, European 7, Gas Light and Coke 83¼, 83⅜, 83½, 84, 4 p.ct. preference 78, 3 p.ct. debenture 59 *ex* div., Imperial Continental 144, 145½, Oriental 103½, 104⅜, Primitiva 9s. 6d., 10s., South Metropolitan 93⅜, 93½, 93⅝, 94, 6½ p.ct. debenture 103½, Wandsworth "B" 110. Supplementary prices, Cambridge University and Town 5 p.ct. debenture (partly paid) ⅛, ¼ premium, Danish 82s. 6d., 85s., Liverpool 5 p.ct. 83⅜.

On Tuesday, Alliance and Dublin 65, Bournemouth "B" 12 11/16, Commercial 4 p.ct. 86, 3½ p.ct. 85, 86, European 7⅛, Gas Light and Coke 83¼, 83⅞, 4 p.ct. preference 78½, 3 p.ct. debenture 59⅞ *ex* div., Imperial Continental 145, Primitiva 10s., South Metropolitan 93, 93⅛, 93¼, 93½, Swansea 103¼, Tottenham 5½ p.ct. preference 103⅜, 104. Supplementary prices, Crowborough consolidated 49½.

On Wednesday, Bombay 19s. 6d., 20s., Bristol 5 p.ct. maximum 92, Commercial 3½ p.ct. 85, Continental Union 31, Gas Light and Coke 83¼, 83⅜, 3 p.ct. debenture 58¾ *ex* div., Imperial Continental 143, 144, 144¼, 3½ p.ct. debenture 72, 72½, Primitiva 9s. 3d., 4 p.ct. debenture (1911) 64, South Metropolitan 3 p.ct. debenture 59, South Suburban 5 p.ct. 93, 94, 95. Supplementary prices, Danish 82s. 6d., 85s., Southend-on-Sea 5 p.ct. new 88.

On Thursday, Gas Light and Coke 83, 83⅛, 83¼, 83⅜, 3½ p.ct. maximum 62, 4 p.ct. preference 78, 78¼, 79, 5 p.ct. debenture 58⅝, 58⅞, 59, 59½, Montevideo 68, Primitiva 9s. 7½d., South Metropolitan 93½, 93⅞, South Suburban 5 p.ct. 93½, 94⅜. Supplementary prices, Redhill 5 p.ct. "B" 80½.

On Friday, Brentford 6 p.ct. Richmond Debentures 100½, Commercial 3½ p.ct. 84, European 6⅞, Gas Light and Coke 82½, 83, 83⅛, 83⅜, 4 p.ct. preference 78, Imperial Continental 142, Montevideo 67⅜, Oriental 103, 104⅜, Primitiva 9s. 3d., 9s. 9d., South Metropolitan 93, 3 p.ct. debenture 58, South Suburban 5 p.ct. 94½. Supplementary prices, Consumers' Gas of Toronto 170, Reading 5 p.ct. maximum 83½, 84.

Calls on the recently issued securities somewhat diminished the available funds in Lombard Street, and short loans to cover the turn of the half-year, for which there was a brisk inquiry, commanded 4⅜ p.ct. Day-to-day loans were renewed at lower rates, 3 p.ct. being finally accepted for the night. The Treasury Bill rate rose again, the average being £4 10s. 5·19d. p.ct., but this was a little below the general expectation.

In the Foreign Exchange Market further depreciations occurred in the "reparation" currencies. French francs closed slightly higher, the rate being 1.90 up at 106.65. Belgian francs left off at 107.20. Italian lire also were sold freely and closed at 135 1/16. Sterling on New York was steady, closing at 4.86 5/16.

Silver was quoted 7/16d. higher for cash at 32⅜d. per oz. The price of gold remained at 84s. 11½d. per oz.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on March 5. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3¼ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. June 26.	Rise + or Fall − on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 5	5	5	Aldershot 5 p.c. max. C.	78—81	..	..
295,492	,,	,,	4	4	Do. 4 p.c. Pref.	71—76	..	..
1,351,868	,,	Apl. 2	6½	6½	Alliance & Dublin Ord.	65—70	..	..
374,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	63—68	..	65
300,000	1	May 7	1/7½	1/7½	Bombay, Ltd.	1/16—1/18	..	..
170,000	10	Mar. 5	8½	8½	Bournemouth 5 p.c.	12—13	..	1/6—20/-
425,050	10	,,	7	7	Do. B 7 p.c..	12½—12¾	..	..
150,000	10	,,	6	6	Do. Pref. 6 p.c..	11—12	..	12 11/16
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb..	55—58*	−1	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb..	76—79*	−2	..
992,045	,,	Mar. 5	6 1/16	6 1/16	Brentford A Con.	95—100	..	..
990,500	,,	,,	6¼	6¼	Do. B New	91—110	..	9⅝
76,000	,,	,,	5	5	Do. 5 p.c. Pref.	95—98	..	..
306,690	,,	June 11	4	4	Do. 4 p.c. Deb.	75—80	..	..
181,337	,,	,,	6	6	Do. 6 p.c. Rich. Red. Deb.	100—105	..	..
214,740	,,	Mar. 5	1½	12½	Brighton & Hove Orig.	165—170	..	170½
244,200	,,	,,	8½	9½	Do. A Ord.	122—125	..	..
1,287,500	,,	Feb. 19	5	5	Bristol 5 p.c. max..	96½—97½*a*	..	..
855,000	,,	Mar. 19	8	7	British Ord..	109—114	..	92
100,000	,,	June 25	7	7	Do. 7 p.c. Pref..	120—125*	−3	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	70—75*	−2	..
100,000	10	May 21	6	8	Cape Town, Ltd.	6—7	..	..
100,000	10	Apl. 23	4½	4½	Do. 4½ p.c. Pref..	6½—7½	..	..
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb..	69—74*	−2	..
626,860	,,	Feb. 19	6	6	Cardiff Con. Ord.	101—104	..	..
237,860	,,	June 25	7½	7½	Do. 7½ p.c. Red. Deb.	101—104*	−3	..
157,150	,,	Feb. 19	5	6½	Chester 5 p.c. Ord.	89½—94½*b*	..	..
1,513,280	,,	Mar. 5	6	5/14/8	Commercial 4 p.c. Cap.	85—88	−1	86
560,000	,,	,,	6	5⅞	Do. 3½ p.c. Cap.	84—87	−2	84—86
475,000	,,	June 11	3	3	Do. 3 p.c. Deb.	56—59	..	..
800,000	,,	14 Jan. 15	—	—	Continental Union, Ltd.	30—35	−4	31
200,000	,,	June 11	7	7	Do. 7 p.c. Pref.	85—89	..	..
660,000	,,	Mar. 5	6½	6½	Croydon sliding scale	98—102	..	..
284,975	,,	,,	5	5	Do. max. div.	83—86	..	..
492,270	,,	Feb. 19	6	9	Derby Con.	110—112*c*	..	..
55,000	,,	Jan. 8	4	4	Do. Deb.	74—76*c*	..	..
1,002,180	1	Jan. 22	6	4	European, Ltd.	62½—7½	..	..
16,460,070	Stk	Feb. 19	5½	5½	Gas Light & Coke 4 p.c. Ord.	82—84	−1	82½—84
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	61—64	−1	*C2*
4,062,235	,,	,,	4	4	Do. 4 p.c. Con. Pref.	78—80	..	78—79
4,761,930	,,	June 11	3	3	Do. 3 p.c. Con. Deb.	58—61	..	58½—59½
130,000	,,	—	10	10	Do. 10 p.c. Bonds	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Mar. 19	6½	6½	Hastings & St. L. 5 p.c. Conv.	93—97	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	73—78	..	..
70,000	10	May 7	10	10	Hongkong & China, Ltd.	17—18	..	..
86,600	Stk.	Mar. 5	10	10	Hornsey 7 p.c.	136—141	..	..
1,976,000	,,	May 21	10	59	Imperial Continental Cap..	140—145	−4	142—145½
263,950	,,	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	71—74	..	72—72½
235,242	,,	Mar. 19	6½	6½	Lea Bridge 5 p.c. Ord..	96—101	..	..
1,127,340	,,	Feb. 19	5½	5½	Liverpool 5 p.c. Ord.	86—87*b*	..	83½
600,000	,,	Mar. 19	7	7	Do. 7 p.c. Red. Pref.	103½—104½*b*	..	..
165,736	,,	Feb. 19	9	8	Maidstone 5 p.c. Cap.	122—132	..	..
63,480	,,	June 25	3	3	Do. 3 p.c. Deb..	52—57*	−1	..
75,000	5	June 25	5	7	Malta & Mediterranean	4—4½*	−½	..
541,920	Stk.	June 11	4	4	Montevideo, Ltd.	65—69	..	67½—68
2,061,315	,,	Mar. 5	5	5	Newcastle & Gateshead Con.	75—77*d*	..	..
300,929	,,	,,	4	4	Do. 4 p.c. Pref..	76—77*d*	..	..
529,705	,,	June 25	3½	3½	Do. 3½ p.c. Deb.	67—68a*	−1½	..
15,000	,,	Mar. 5	11	12	North Middlesex 10 p.c.	..	..	..
75,940	,,	,,	7 1/10	8⅝	Do. 7 p.c.	..	..	..
300,000	Stk.	May 7	9	7	Oriental, Ltd.	100—105	..	103—104½
188,120	,,	June 25	7⅛	7½	Plym'th & Ston'house 5 p.c.	108—113*	−2	..
60,000	50	Mar. 5	13	14	Portsea Island B	96—99	..	..
2,289,909	1	—	—	—	Do. C	93—98	..	..
311,100	100	June 2	4	4	Primitiva Ord.	9/3—10/3	..	9/3—10/-
600,000	Stk.	Jan. 22	4	4	Do. 4 p.c. Red. Deb..	78—80	..	..
220,335	,,	June 25	4	4	Do. 4 p.c. Red. Deb. 1911	64—66	..	..
321,670	,,	,,	4	4	Do. B. Aires 4 p.c. Rd. Db.	64—65*	−2	64
150,000	10	Mar. 19	6	6	Do. R'r P'te 4 p.c. Rd. Db.	63—65*	−2	..
125,000	50	Jan. 2	5	5	San Paulo 6 p.c. Pref.	7⅛—8⅛	..	..
270,000	Stk.	Mar. 19	5½	5½	Do. 5 p.c. Red. Deb.	43—46	..	..
419,968	,,	,,	5½	5½	Sheffield A	104—106*e*	..	..
1,047,000	,,	,,	5½	5½	Do. B	104—106*e*	..	..
90,000	10	June 11	6	4	Do. C	104—106*e*	..	..
6,609,895	Stk.	Feb 19	5	6½	South African	7—9	..	..
1,895,445	,,	Jan. 8	3	3	South Met. Ord..	92½—94½	+½	..
734,000	,,	Mar. 5	6½	6½	Do. 3 p.c. Deb..	58—61	−1	93—94
91,500	,,	Mar. 5	8½	8½	Do. 6½ p.c. Red. Deb.	102½—104½	..	58—59
1,187,795	,,	Feb. 19	6½	6½	South Shields Con.	135—136*d*	..	103½
368,837	,,	June 25	5	5	South Suburban Ord. 5 p.c.	93—96	−1	..
647,740	,,	May 7	5	5	Do. 5 p.c. Deb.	95—98*	−2	93—95
121,275	,,	June 25	4	4	South'mpt'n Ord. 5 p.c. max.	80—83	..	..
250,000	,,	Mar. 5	7	7	Do. 4 p.c. Deb.	70—75*	−2	..
200,000	,,	June 25	6½	6½	Swansea 7 p.c. Red. Pref..	102—104	..	103½
120,000	,,	Feb. 19	8	8	Do. 6½ p.c. Red. Deb..	100—102*	−3	..
882,275	,,	,,	6½	6½	Tottenham District A 5 p.c.	116—119	..	..
150,000	,,	,,	—	—	Do. B 3½ p.c.	93—98	..	..
181,255	,,	June 11	4	4	Do. 5½ p.c. Pref.	103—105	..	..
258,251	,,	Mar. 19	5	5	Do. 4 p.c. Deb.	76—79	..	103½—104
197,294	,,	Feb. 19	6½	6½	Tynemouth Con. and New	74—76*d*	..	..
88,330	,,	,,	8	8	Uxbridge, Maidenhead, & Wycombe 5 p.c..	95—100	..	..
91,800	,,	,,	5	5	Do. 5 p.c. pref..	95—100	..	..
			—	6½	Do. 5 p.c. Maidenh'd	90—95	..	..
30,000	,,	Mar. 5	9½	9½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	130—135	..	..
353,636	,,	,,	7½	7½	Do. B 3½ p.ct.	110—115	..	110
392,953	,,	,,	6/9/6	6/9/6	Do. C and New	95—100	..	..
352,000	,,	,,	7⅞	7⅞	Wimbledon 5 p.ct.	105—110	..	..
98,000	,,	,,	7⅞	7⅞	Epsom 5 p.ct..	112—117	..	..
88,416	,,	June 25	3	3	3 p.c. Deb.	55—58*	−2	..

Quotations at :—*a*,—Bristol. *b*,—Liverpool. *c*,—Nottingham. *d*,—Newcastle, *e*,—Sheffield. * Ex. div.

Patent Retorts, Ltd.—This is the title of a private Company registered, with a nominal capital of £2250, in £1 shares, to acquire patents relating to, or connected with, the distillation or carbonization of coal or other carbonaceous substances. Nos. 40-43, Norfolk Street, W.C., are the registered offices.

Smoke Abatement Legislation.—A deputation from the London County Council waited upon the Minister of Health (the Rt. Hon. Neville Chamberlain, M.P.) on June 8, to place before him certain resolutions passed by the Council on the subject of matters in connection with London's health services which call for the attention of the Government. One of the matters enumerated was the need for comprehensive legislation dealing with the question of smoke abatement. As to this, Mr. Chamberlain stated that the introduction of a Smoke Abatement Bill was in the Government programme for next year, and that he hoped it might be possible to bring this Bill in and get it placed upon the Statute Book by the end of the year. He would be glad to have further information regarding the views of the Council as to the administration being central or local.

Newcastle-upon-Tyne Capital Issue.—Tenders are being asked for by the Directors of the Newcastle-upon-Tyne and Gateshead Gas Company for £60,000 of 4 p.ct. irredeemable preference stock (1901), at a minimum price of £75 per £100 of stock. The average profits for the past three years have been sufficient, after meeting all prior charges, to cover the dividend on the preference stocks of the Company, including the present issue, more than eight times. The Company acquired last year the undertakings of the Walker and Wallsend Union Gas Company and the Chester-le-Street Gas Light Company, Ltd. The quantity of gas sold by the Company in 1924 showed an increase of 4¾ p.ct. upon the total sales of the three Companies for the previous year. The total quantity of gas sold in 1924 was 19,964,225 therms, and the number of consumers at Dec. 31 was 146,930. The money to be raised by the present issue is required for the increase of the Company's plant and mains to meet the increasing demand for gas. Tenders for the stock will be received at the offices of the Company not later than 10 a.m. on Wednesday, July 8.

South Suburban Gas Company's Standard Price.—Recommending to the London County Council that application be made to the Board of Trade for an Order reducing the standard price applicable to the South Suburban Gas Company, the Public Control Committee say they have had before them Mr. Arthur Valon's report with regard to the Company, and from the figures submitted they are satisfied that, in view of the fall in costs since the Board of Trade in 1921 fixed the present standard price, there is a strong case for a substantial reduction. The Company's present standard price is 15d. a therm, and the actual price charged to the consumer 11d. a therm.

Ipswich Gas Company Sports Association.—A pleasant outing was enjoyed by members of the Association on Saturday, June 20, when tennis and bowls teams visited Norwich, and engaged in matches against representatives of the British Gas Light Company. The teams were accompanied by Mr. F. Prentice (Engineer and Manager) and Mr. G. A. Mallett (Secretary). The Norwich men proved themselves superior to the visitors at bowls, winning by 80 shots to 46. At tennis, however, the visitors were victorious by seven matches to two. The Ipswich teams were entertained to tea by their hosts, after which Mr. Prentice, on behalf of the visitors, thanked their hosts. Mr. Glover suitably responded. The return matches take place on July 25, when the Norwich teams will be entertained by the Ipswich Company's Sports Association.

The warehouse staff of Messrs. Falk, Stadelmann, & Co., Ltd., London, had their annual outing on Saturday, June 20; a special train taking the party (about 500) to Brighton. Lunch, which was presided over by the Chairman, Mr. Max Falk, assisted by Mr. L. Thurner, Managing Director, was served at the Dome. The outing was a great success.

The annual outing on June 20 of Messrs. J. & W. B. Smith, Ltd., of Farringdon Road, E.C., was to Ye Old Rye House, where there was a successful sports meeting and social evening. The various races arranged aroused keen competition during the afternoon. At the tea the toast of the firm and Directors was given by Mr. Sloper, and replied to by the Managing Director (Mr. A. H. Miller). Prizes were presented in the ballroom by Mrs. Miller, and an enjoyable day concluded with a concert and dance.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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See Advertisement, June 17, p. 829.

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Offers to be lodged with The MANAGER, GAS WORKS, DUMBARTON, by the 10th of July, 1925.

FOR SALE.—Tully Gas Plant. Generator Double Valve, Scrubber, Washbox, Coke Elevator, Staging with Ladder, Keighley Gas Engine direct coupled to Keith and Blackman Fan.

For full Particulars apply to the MANAGER, GAS-WORKS, SWADLINCOTE, near BURTON-ON-TRENT.

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LANCASTER CORPORATION.

(GAS DEPARTMENT.)

TENDERS are invited from Public Works' Contractors for EXCAVATING, LAYING, and RE-INSTATING 1500 Yards of 18-in. GAS MAIN, from Gas-Works to centre of Town.

Tenders to be sent to the undersigned by July 8 next.

Particulars and Specification may be had from GEO. DIXON, B.Eng., A.M.I.C.E., Engineer and Manager.

Gas-Works, Lancaster, June 16, 1925.

TIPTON URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Council invite Offers for the Purchase of SURPLUS DEHYDRATED TAR. Particulars may be obtained from the Engineer and Manager (Mr. William Prince), Gas-Works, Tipton.

Applications to be Delivered to the undersigned not later than Monday, July 13.

J. H. STOCKDALE, Clerk to the Council.

Public Offices, Tipton, June 29, 1925.

TIPTON URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Council invite Tenders for the Supply and Erection of a 10 cwt. HAND OVERHEAD RUNWAY, to be fitted with an Overhead RECORDING WEIGHING MACHINE Incorporated in the Runway.

Specifications and Drawing may be seen at the Gas-Works Offices, Alexandra Road, Tipton.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders, sealed and endorsed "Tender for Runway," to be Delivered to the undersigned not later than Monday, July 13.

J. H. STOCKDALE, Clerk to the Council.

Public Offices, Tipton, June 29, 1925.

BOROUGH OF CLITHEROE.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of 8000 Tons of GAS NUTS, UNSCREENED COAL, and ROUGH DRY SLACK, to be Delivered on the Gas-Works Siding between the 31st of July, 1925, and the 31st of July, 1926.

Particulars and Forms of Tender may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Gas Coal," addressed to the Chairman of the Gas Committee, to be Delivered at my office on or before Saturday, July 4, 1925.

R. BARRETT, Engineer and Manager.

Gas-Works, Clitheroe, June 16, 1925.

HAVERHILL URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Haverhill Urban District Council invite TENDERS for the Supply of 1500 Tons of BEST GAS COAL (Screened or Unscreened) to be Delivered at the Haverhill (L. & N.E.R.) Station, in such quantities and at such periods as may be ordered from time to time, between the 31st day of July next and the 30th day of June, 1926.

No Form of Tender is provided, nor will be supplied.

The Council reserve the right to divide the Contract as they think fit, and do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Gas," to be Delivered to me on or before the 15th day of July, 1925.

JAMES BEASLEY, Clerk.

Haverhill, Suffolk, June 18, 1925.

COMPANY NOTICES.

COMMERCIAL GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO CAPITAL STOCKS, WILL BE CLOSED from the 6th of July to the 5th of August, both days inclusive.

By order of the Board, F. J. BRADFIELD, General Manager and Secretary.

Offices, Stepney, E. 1, June 25, 1925.

EUROPEAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given that the ANNUAL GENERAL MEETING of the Shareholders will be held on Tuesday, the 7th day of July, at 12.30 p.m. precisely, at the Offices, Montague House, Devonshire Square, London, pursuant to the Regulations of the Company:—

To receive the Report of the Directors and the Accounts of the Company for the year ended 31st March, 1925;

To declare a Dividend;

To elect Directors and Auditors in the place of those retiring; and

To transact the Ordinary Business of such Meeting.

The accounts to be submitted to the shareholders will be open for inspection at the Company's offices on and after the 29th of June.

The TRANSFER BOOKS WILL BE CLOSED from the 14th of July to the 31st of July, both days inclusive. In accordance with Clause 48 of the Company's Articles of Association, the Bearer of a Share Warrant may, on depositing his Warrant at the Office not less than 48 hours before the time of holding any meeting of the Company, with a statement in writing of his name and address, be present at such meeting, and vote thereat in respect of the shares included in such Warrant.

By order of the Board, F. ELIOT WILLIAMS, General Manager and Secretary.

Montague House, Devonshire Square, London, E.C. 2. June 26, 1925.